MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for October, 1899, is based on reports from about 3,024 stations furnished by paid and voluntary observers, classified as follows: regular stations of the Weather Bureau, 170; West Indian service stations, 10; cotton region stations, 127; corn and wheat region stations, 133; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,238; Army post hospital reports, 27; United States Life-Saving Service, 14; Southern Pacific Railway Company, 96; Canadian Meteorological Service, 32; Mexican Telegraphic Service, 20; Mexican voluntary stations, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Senor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Señor A. M. Chaves, Director-General of Mexican Telegraphs; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I Kimball, Superintendent of the United States Life-Saving Service; and Capt. J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The most important storm of October, 1899, advanced from the west part of the Caribbean Sea along the Atlantic coast of the United States from the 28th to the 31st. For several days preceding the 28th unsettled weather had prevailed over the Greater Antilles and the western Caribbean Sea, and a marked barometric gradient between that region and an area of high barometer over the southeastern part of the United States caused high northeasterly winds over southern Florida, western Cuba, and adjacent waters. During this period Gulf and Atlantic coast shipping interests were advised of the conditions which prevailed, and careful watch was kept for a storm development which, at this season, these conditions favored. The evening reports of the 27th showed the looked-for storm development south of central Cuba, and storm signals were ordered at Key West and Miami, Fla., with the information that the center of the disturbance would probably move northwestward during the next twenty-four hours and cause high northeast winds over southern Florida and western Cuba. Similar advices were telegraphed to all Florida ports. During the 28th the storm signals were extended along the Atlantic coast to Jupiter, Fla., and the Bureau of Navigation, Navy Department, the Philadelphia and New York Maritime Exchanges, and Atlantic and eastern Gulf shipping interests, and also the Colonial Government of the Bahamas, were advised that the Caribbean Sea disturbance was approaching the south coast of central Cuba and that dangerous northeast gales were indicated for the southern Florida and west Cuban coasts, and southeast gales for the east Cuban coasts. The morning of the 29th south Atlantic and east Gulf ports were notified that the storm was moving northward over central Cuba, and in the evening of that day storm signals were ordered as far north as Norfolk, Va., with the information that the storm had advanced to a position east of Key West, Fla., and that during the following day northeast gales would prevail from Virginia southward, and that northeast gales would shift to northwest over the Florida Peninsula. During the 30th the center of disturbance moved northward, and in the evening was central off the Carolina coast. On the morning of the 30th the display of storm signals was extended to Sandy Hook, N. J., and advisory messages regarding the character and course of the storm were sent northward to Boston, Mass. The morning reports of the 31st showed a marked increase in the intensity of this storm, and coast interests along the middle Atlantic and south New England coasts were notified that dangerous northeast gales might be expected. During the northward passage of this storm severe gales were encountered along the south and middle Atlantic and south New England coasts.

In Cuba and Jamaica the feature of the storm was the exceptionally heavy rainfall. In Florida, Georgia, and South Carolina no special damage was caused, although dangerous gales prevailed off the coasts. At Charleston, S. C., the wind

reached a velocity of 58 miles an hour from the northwest at 10:05 p. m. of the 30th. The night of the 30th the storm was one of the severest on record along the North Carolina coast near Wilmington, and an enormous amount of damage was caused by exceptionally heavy seas and high tides. The total loss of property in that section was placed at a quarter of a million dollars. A number of coasting vessels were lost, and the steamer *Catherine Whiting* was wrecked on Goss Beach, Brunswick County. The value of sailing vessels and their cargoes, which were lost along the North Carolina coast, was placed at $144,000. The ravages of the storm along the Virginia coast the night of the 30th, and during the 31st represented losses of thousands of dollars. The tide was the highest noted in years, and the high wind caused the water to overflow lowlands. At Cape Henry the wind reached a velocity of 60 miles an hour from the northeast at 6:55 p. m. of the 30th. On the New Jersey coast thousands of dollars worth of fishing property was saved by fishermen who profited by the Weather Bureau warnings, and nets to the value of thousands of dollars were lost by fishermen who did not heed the warnings. Severe gales were reported at the more exposed points along the south New England coast, but as shipping had been warned more than twenty-four hours before the storm arrived no damage was caused.

The break in the period of unseasonable high temperature over the interior of the country was accurately covered by forecasts from the 24th to the 27th.

Warnings of the beginning and ending of the first autumnal rains in California were of great value to raisin growers, fruit driers, and shipping interests.

Ample warnings were sent of the first heavy frosts of the season to the various sections which were visited by heavy frost.

On the 14th and 15th an exceptionally severe snowstorm for the season visited the foothills of the main range of the Rocky Mountains in northern Montana, causing the death of a number of men and the loss of several thousand sheep.

CHICAGO FORECAST DISTRICT.

The Lake region was remarkably free from dangerous storms during October, no storm being sufficiently severe to require the general display of signals at all upper lake ports.

The break in the heated period and the general showers which occurred from the 24th to the 27th were almost accurately forecast.—*H. J. Cox, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

No wind signals were ordered, and there were no dangerous winds.

Frost warnings were issued and verified. No damage was caused by frost, except to grapes in exposed places.—*B. S. Pague, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

On the 10th a storm which was noticed first on the Mexican frontier (one of the Sonora type) was central over the San Joaquin and Sacramento valleys. A fall in pressure along the north coast occurring at the same time the forecaster felt certain in forecasting showers for northern California. No rain had fallen for some months, except a trace, and the forecast was merely a statement of the approach of the winter season. It was so regarded by the community. On the 11th forecasts of showers were continued and were sent for Nevada, Utah, and the mountains of Arizona. It was also stated that the snow in the mountains would probably be heavy. All of these forecasts were verified. Ample warnings were given to rasin growers, fruit driers, and the shipping interests. Rain was again forecast for the district named on the 12th, and on the 13th forecasts of clearing weather by Saturday were made, which were also verified. Extensive forest fires were raging at many places in California, and a forecast of the rain which came the night of the 10th and extinguished them was of special interest to those engaged in fighting the fires.

The following, from an editorial in the San Francisco Chronicle of November 14, 1899, is one of many similar comments made by the California press regarding the rain warnings:

> Nowhere are weather predictions more uncertain than in California, although every device known to meteorologists has been enlisted to wrest the secrets of the atmosphere from it, but the weather observer is always handicapped here because information regarding the atmospheric conditions far out at sea is inaccessible at the critical time. Still, with all its imperfections and drawbacks, meteorology has occasionally been very serviceable here. The foreknowledge acquired through it of the approach of the October rainstorm and the timely warning given to agriculturists enabled them to save much property from damage and destruction. In a large section of the State over which these early storms swept there was nothing to indicate their coming at the time the warning was given. Faith in the meteorological forecast of the storm saved one Hanford, Kings County, vineyardist 56,800 trays of rasins, worth about $2 per tray, or a total money value of $113,600. It is thus science demonstrates that it has a money value when applied to industry. If other farmers and rasin growers in the interior of the State had placed similar faith in the deductions of the professional meteorologist they would not now be mourning the loss of their unprotected crops. The mariner respects the storm flag in whatever port he may be when that signal of danger to his floating craft is raised, and he makes everything snug to meet the coming blow, of which it gives him timely warning. Thus meteorology has become an invaluable aid to maritime interests.

A. G. McAdie, Forecast Official.

HAVANA FORECAST DISTRICT.

From the 22d to the morning of the 30th unusually stormy weather prevailed over Cuba, Jamaica, and the western Caribbean Sea. The only serious damage done by the storm was the sinking of the small schooner *Helen E. Russell*, and the loss of four lives at 4 a. m. of the 23d, 8 miles northwest of Juraco; the following is extracted from local newspapers:

> Evening of 28th 13 houses blown down and tobacco seed plants and banana plants destroyed; night of 28th considerable damage done by inundation of a portion of Camajuani and the blowing down of several houses at Sancti Spiritus; damage and loss of one life at Santiago, and damage by the overflowing of the Canti River.

All necessary action was taken to acquaint commercial and shipping and other interests of the development, character, and course of this storm.—*W. B. Stockman, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

During the month six highs and ten lows have been sufficiently well defined to be traced on Charts I and II. The accompanying table shows some of the facts regarding the date and place of origin and last appearance, with the velocity of their movements, and the following description is added:

Highs.—No. I was first seen off the middle Pacific coast. Its trajectory was a little south of east, and after five days it disappeared in north Texas. No. II was first noted to the north of Minnesota. The remaining four were first noted in the middle or northern Plateau regions. All of these five had a path in a general easterly direction and disappeared off the north Atlantic or Nova Scotia coasts.

Lows.—No. VIII was first noted off the north Pacific coast; Nos. I, IV, and VII to the north of Montana; Nos. V and VI in the south Plateau; No. X in Texas, and Nos. II, III, and IX in the eastern Gulf. The beginning of these last three was especially interesting, as there was a more or less disturbed condition in the eastern Gulf of Mexico for several days before the storms gathered enough intensity to move to the north and east. The general paths of the storms was toward the east and north. No. VI was last seen in Manitoba; Nos. I and VIII in Nebraska; No. III off Cape Cod, and Nos. II, V, IX, and X in or near the Gulf of St. Lawrence.—*H. A. Hazen, Professor.*

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	43	127	5, p. m.	37	102	1,650	4.5	367	15.3
II	6, a. m.	51	91	9, p. m.	47	61	1,530	3.5	437	18.2
III	12, p. m.	52	117	17, a. m.	43	64	3,330	4.5	740	30.8
IV	17, p. m.	47	109	24, a. m.	42	69	3,540	6.5	545	22.7
V	24, p. m.	43	118	28, p. m.	47	61	2,820	4.0	705	29.4
VI	26, p. m.	41	114	*1, a. m.	47	57	3,090	5.5	562	23.4
Total							15,960	28.5	3,356	139.8
Mean of 6 paths							2,660		559	23.3
Mean of 28.5 days									560	23.3
Low areas.										
I	†29, p. m.	54	119	2, a. m.	41	100	1,350	2.5	540	22.5
II	3, a. m.	22	83	7, a. m.	46	59	2,280	4.0	570	23.8
III	7, a. m.	29	84	9, p. m.	40	69	1,500	2.5	600	25.0
IV	7, p. m.	55	116	10, a. m.	49	92	1,200	2.5	480	20.0
V	11, a. m.	40	108	14, p. m.	51	62	2,790	3.5	797	33.2
VI	14, a. m.	34	111	16, p. m.	53	95	1,620	2.5	648	27.0
VII	16, p. m.	49	1.0	18, p. m.	48	84	1,290	2.0	645	26.9
VIII	18, p. m.	46	128	24, a. m.	42	98	2,490	5.5	453	18.9
IX	26, a. m.	19	79	*2, a. m.	48	56	3,150	7.0	450	18.7
X	26, p. m.	30	100	30, a. m.	48	52	3,120	3.5	891	37.1
Total							20,790	35.5	6,074	253.1
Mean of 10 paths							2,079		607	25.3
Mean of 35.5 days									586	24.4

*November. †September.

RIVERS AND FLOODS.

In the Mississippi River during the month of October, 1899, the stages of water were above the average, and higher than during the corresponding season of 1898, while the Missouri and that portion of the Mississippi south of Alton, Ill., were considerably lower than in 1898. The higher stages above were due to heavy rains at the headwaters of the Mississippi, supplemented by lighter falls southward through Iowa. At St. Paul a stage of 8.8 feet was reached on the 24th, the highest for the season since 1881, when a stage of 13 feet was attained on October 9th.

A marked rise also occurred in the rivers of the South Atlantic States in the early part of the month on account of the heavy rains which resulted from the storm which moved up the South Atlantic coast from the 5th to the 7th. The crests were reached about the 9th. At Fayetteville, N. C., the Cape Fear River rose 15 feet in three days, and at Camden, S. C., the Wateree River rose 13 feet in four days.

Over the remaining rivers low stages continued with practically no interruption. In the Mississippi system below the mouth of the Missouri the waters were lowest during the closing days of the month, while over the eastern rivers the times of lowest stages were variable.

The highest and lowest water, mean stage, and monthly range at 121 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

Heights of rivers referred to zeros of gages, October, 1899.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	8.8	24	4.0	9-11	5.9	4.8
Reads Landing, Minn	1,884	12	6.3	29, 30	1.4	12, 15	3.1	4.9
La Crosse, Wis	1,819	12						
North McGregor, Iowa	1,759	18	6.1	31	2.0	18-20	3.0	4.1
Dubuque, Iowa	1,699	15	5.4	31	2.1	19	2.9	3.3
Leclaire, Iowa	1,609	10	2.9	31	1.2	20-23	1.6	1.7
Davenport, Iowa	1,593	15	3.8	31	1.9	21, 22	2.4	1.9
Muscatine, Iowa	1,562	16	4.6	31	2.4	23	3.0	2.2
Galland, Iowa	1,472	8	1.6	31	0.9	19-26	1.1	0.7
Keokuk, Iowa	1,463	15	2.4	31	0.7	23-26	1.2	1.7
Hannibal, Mo	1,402	13	3.2	1, 2	1.9	25-27	2.3	1.3
Grafton, Ill	1,306	23	4.1	1	2.7	25-27	3.2	1.4
St. Louis, Mo	1,264	30	4.8	1	2.9	26	3.7	1.9
Chester, Ill	1,189	36	3.1	1	1.7	26	2.3	1.4
Memphis, Tenn	843	33	2.2	1	0.5	31	1.1	1.7
Helena, Ark	767	42	4.4	1	1.8	30, 31	2.7	2.6
Arkansas City, Ark	635	42	3.9	1	1.1	21-24, 31	2.0	2.8
Greenville, Miss	595	42	3.5	1, 2	1.4	30-31	2.2	2.1
Vicksburg, Miss	474	45	2.2	1	−1.0	25-27, 31	0.2	3.2
New Orleans, La	108	16	4.6	4	2.9	18-20	3.5	1.7
Missouri River.								
Bismarck, N. Dak	1,309	14	2.2	3	1.5	14, 15	1.8	0.7
Pierre, S. Dak	1,114	14	2.7	1	2.4	13-17, 20-28	2.5	0.3
Sioux City, Iowa	784	19	5.1	18	4.7	9	4.9	0.4
Omaha, Nebr	669	18	6.6	1-6	6.4	12-15, 22-28	6.5	0.2
Plattsmouth, Nebr	641							
St. Joseph, Mo	481	10	1.4	28	0.7	13-15, 24-25	0.9	0.7
Kansas City, Mo	388	21	6.0	28, 29	5.3	15-17	5.5	0.7
Boonville, Mo	199	20	5.7	1, 2	4.9	21-28	5.1	0.8
Hermann, Mo	103	24	5.2	1, 2	4.5	20-22	4.8	0.7
Illinois River.								
Peoria, Ill	135	14	4.6	28	4.0	1-11	4.2	0.6
Youghiogheny River.								
Confluence, Pa	59	10	1.0	1	0.1	28, 29	0.5	0.9
West Newton, Pa	15	23	0.4	1	0.0	30-31	0.1	0.4
Allegheny River.								
Warren, Pa	177	14	1.0	3	0.0	27-31	0.3	1.0
Oil City, Pa	123	13	1.4	2	0.1	27-29	0.5	1.3
Parker, Pa	73	20	1.1	4, 5	0.1	24-29	0.5	1.0
Monongahela River.								
Weston, W. Va	161	18	−1.0	1, 2	−2.0	22-25	−1.7	1.0
Fairmont, W. Va	119	25	0.6	1	0.1	26-29	0.3	0.5
Greensboro, Pa	81	18	6.8	1	6.0	22-31	6.3	0.8
Lock No. 4, Pa	40	28	8.5	1-3	5.9	31	7.4	2.6
Conemaugh River.								
Johnstown, Pa	64	7	1.2	1-3, 11, 12	0.5	27-30	0.9	0.7
Red Bank Creek.								
Brookville, Pa	35	8	0.4	29-31	0.2	1-28	0.2	0.2
Beaver River.								
Ellwood Junction, Pa	10	14	−0.2	1, 2	−0.5	7, 16, 17	−0.4	0.3
Great Kanawha River.								
Charleston, W. Va	61	30	6.8	1, 2, 12	6.4	25, 26	6.6	0.4
New River.								
Hinton, W. Va	95	14	1.5	12	1.0	23-29	1.1	0.5
Cheat River.								
Rowlesburg, W. Va	36	14	1.0	1	−1.2	26-31	−0.3	2.2
Ohio River.								
Pittsburg, Pa	966	22	6.2	1	5.2	6, 10, 14	5.6	1.0
Davis Island Dam, Pa	960	25	2.9	1, 4-6	1.5	29	2.2	1.4
Wheeling, W. Va	875	36	2.8	6	1.1	22-31	1.7	1.7
Parkersburg, W. Va	785	36	3.0	9	1.5	26-28	2.2	1.5
Point Pleasant, W. Va	703	39	2.0	10-13	1.1	27-31	1.5	0.9
Catlettsburg, Ky	651	50	1.7	10	0.8	29-31	1.2	0.9
Portsmouth, Ohio	612	50	3.2	14, 15	2.2	29-31	2.7	1.0
Cincinnati, Ohio	499	50	4.4	17	3.5	25-30	3.9	0.9
Louisville, Ky	367	28	5.0	1	4.2	28	4.6	0.8
Evansville, Ind	184	35	2.6	1-3	1.6	31	2.0	1.0
Paducah, Ky	47	40	1.1	1	0.5	13, 16	0.8	0.6
Cairo, Ill	1,073	45	4.7	1	3.0	15, 16, 27	3.5	1.7
Muskingum River.								
Zanesville, Ohio	70	20	6.1	31	5.6	28	5.8	0.5
Miami River.								
Dayton, Ohio	69	18	1.1	29	0.5	1, 22	0.7	0.6
Wabash River.								
Mount Carmel, Ill	80	15	1.0	23, 24, 28-30	0.3	1-18	0.6	0.7
Licking River.								
Falmouth, Ky	30	25	1.6	29, 31	0.3	11-19	0.5	1.3
Clinch River.								
Speers Ferry, Va	156	20	−0.2	9, 30, 31	−0.8	26, 27	−0.6	0.6
Clinton, Tenn	46	25	3.4	1	1.8	24-28	2.2	1.6
Tennessee River.								
Knoxville, Tenn	614	28	0.2	11	−1.2	27-29	−0.7	1.4
Kingston, Tenn	534	25	1.2	11, 12	0.5	3, 4	0.8	0.7
Chattanooga, Tenn	430	33	1.9	12	0.8	6, 7, 27, 28	1.1	1.1
Bridgeport, Ala	390	24	0.6	13	0.1	5-7, 18, 19, 26-31	0.2	0.5
Florence, Ala	220	16	0.4	16-18	−0.1	10, 30, 31	0.1	0.5
Riverton, Ala	190	25	−1.0	16-18	−1.9	9, 10, 30, 31	−1.6	0.9
Johnsonville, Tenn	94	21	0.7	18-20	0.0	11-13	0.3	0.7

Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Cumberland River.	*Miles.*	*Feet.*	*Feet.*	*Feet.*			*Feet.*	*Feet.*
Burnside, Ky	434	50	−0.4	12-15,29-31	− 0.7	7	−0.5	0.3
Carthage, Tenn	257	40	0.5	18	− 0.1	8	0.2	0.6
Nashville, Tenn	175	40	1.0	18	0.6	2,3,6,7,9,10	0.8	0.4
Arkansas River.								
Wichita, Kans	726	10	3.1	27	1.5	15	1.9	1.6
Webbers Falls, Ind. T	413	23	2.4	31	1.3	13-15,19-25	1.4	1.1
Fort Smith, Ark	351	22	3.1	31	1.4	10,11	1.9	1.7
Dardanelle, Ark	256	21	1.6	3-5	0.9	26,27	1.2	0.7
Little Rock, Ark	176	23	2.9	1,2,6	2.3	24-31	2.6	0.6
White River.								
Newport, Ark	150	26	1.3	19,20	0.7	11,12	1.0	0.6
Yazoo River.								
Yazoo City, Miss	80	25	−2.3	31	−2.6	11-28	−2.5	0.3
Red River.								
Arthur City, Tex	688	27	13.7	30	4.8	24-26	5.9	8.9
Fulton, Ark	565	28	.....	.....	.....	.....	.....	.....
Shreveport, La	449	29	2.4	2	− 0.7	30,31	0.4	3.1
Alexandria, La	189	33	−0.5	7-11	− 2.4	23-28	−1.6	1.9
Ouachita River.								
Camden, Ark	340	39	3.0	31	2.4	14-20	2.6	0.6
Monroe, La	100	40	0.0	1-31	0.0	1-31	0.0	0.0
Atchafalaya River.								
Melville, La	100*	31	3.8	5-8,11,12	2.3	31	3.3	1.5
Susquehanna River.								
Wilkesbarre, Pa	178	14	−1.0	1,2	− 2.0	5-31	−1.9	1.0
Harrisburg, Pa	70	17	1.1	1	0.2	24-26	0.5	0.9
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	0.5	2,3	0.1	30,31	0.3	0.4
Juniata River.								
Huntingdon, Pa	80	24	3.0	1-9	2.8	10-31	2.9	0.2
Potomac River.								
Harpers Ferry, W. Va	170	16	1.2	1	0.2	29-31	0.6	1.0
James River.								
Lynchburg, Va	257	18	0.6	8	0.0	18-30	0.1	0.6
Richmond, Va	110	12	0.7	8	− 2.8	29	−1.2	3.5
Roanoke River.								
Weldon, N. C.	90	40	10.4	10	7.5	4,5	8.1	2.9
Cape Fear River.								
Fayetteville, N. C	100	38	17.0	9	1.4	5	4.6	15.6
Lumber River.								
Fairbluff, N. C	10	6	2.7	21	0.3	7	1.4	2.4
Edisto River.								
Edisto, S. C	75	17	5.0	11	1.2	5	2.9	3.8
Pedee River.								
Cheraw, S. C	145	27	7.1	9	0.7	4,5	1.9	6.4

Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Black River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Kingstree, S. C	60	12	3.0	1	1.6	24-31	2.1	1.4
Lynch Creek.								
Effingham, S. C	35	12	8.5	16	2.3	6	3.9	6.2
Santee River.								
St. Stephens, S. C	50	12	7.0	13	− 0.9	7	2.2	7.9
Congaree River.								
Columbia, S. C	37	15	3.7	6	0.0	1,3,24	0.5	3.7
Wateree River.								
Camden, S. C	45	24	15.0	9	2.7	4,5,25	4.6	12.3
Waccamaw River.								
Conway, S. C	40	7	3.0	7	1.2	1,2	2.1	1.8
Savannah River.								
Calhoun Falls, S. C	347	.....	3.9	8	2.1	2,3,27,28	2.5	1.8
Augusta, Ga	268	32	14.0	9	4.7	3	6.7	9.3
Broad River.								
Carlton, Ga	30	.....	4.3	8	1.9	1-4	2.2	2.4
Flint River.								
Albany, Ga	80	20	3.4	22	− 0.4	1	1.8	3.8
Chattahoochee River.								
West Point, Ga	239	20	3.1	16	1.7	11	2.3	1.4
Coosa River.								
Rome, Ga	225	30	1.0	11	0.3	2-5	0.6	0.7
Gadsden, Ala	144	18	0.5	12	− 0.8	1-6	−0.5	1.3
Alabama River.								
Montgomery, Ala	265	35	0.8	23	− 0.4	2,3	0.2	1.2
Selma, Ala	212	35	0.0	24,25	− 1.6	7	−0.6	1.6
Tombigbee River.								
Columbus, Miss	285	33	− 3.5	21,29,30	− 3.8	1,2,11,12	−3.7	0.3
Demopolis, Ala	155	35	− 3.3	1-6,20	− 3.6	25,26,12,16	−3.5	0.3
Black Warrior River.								
Tuscaloosa, Ala	90	43	− 0.6	28	− 1.8	3,4	−1.1	1.2
Columbia River.								
Umatilla, Oreg	270	25	6.6	1,2	4.7	21,31	5.5	1.9
The Dalles, Oreg	166	40	10.0	1	6.6	31	7.8	3.4
Willamette River.								
Albany, Oreg	99	20	11.5	21	1.2	14-16	3.2	10.3
Portland, Oreg	10	15	7.8	20,21	2.3	14	4.4	5.5
Sacramento River.								
Red Bluff, Cal	241	23	4.0	21	− 0.9	1-10	0.2	4.9
Sacramento, Cal	70	29	17.5	22	7.4	4-12	9.9	10.4

*Distance to Gulf of Mexico.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Rainfall is expressed in inches.

Alabama.—The mean temperature was 66.2°, or 3.3° above normal; the highest was 94°, at Jasper on the 13th, and the lowest, 29°, at Jasper on the 1st. The average precipitation was 2.18, or 0.08 above normal; the greatest monthly amount, 7.03, occurred at Newton, and the least, 0.55, at Warrior.—*F. P. Chaffee.*

Arizona.—The mean temperature was 63.0°, or 1.1° below normal; the highest was 107°, at Sentinel on the 1st, and the lowest, 15°, at Snowflake on the 27th. The average precipitation was 0.80, or 0.06 below normal; the greatest monthly amount, 4.89, occurred at Flagstaff, while none fell at several stations.—*W. G. Burns.*

Arkansas.—The mean temperature was 65.6°, or 4.0° above normal; the highest was 101°, at Conway on the 13th, and the lowest, 28°, at Mossville on the 31st. The average precipitation was 2.88, or 0.55 above normal; the greatest monthly amount, 6.52, occurred at Winslow, and the least, 0.76, at Helena.—*E. B. Richards.*

California.—The mean temperature for the State, obtained by weighting the reports from 281 stations, so that equal areas have about the same weight, was 58.1°, or 2.7° below normal, as determined from 195 records; the highest was 107°, at Healdsburg, Sonoma County, on the 8th, and the lowest, zero, at Bodie, Mono County, on the 14th. The average precipitation, as determined by the records of 300 stations, was 3.50; the excess, as indicated by reports from 204 stations, which have normals, was 2.59; the greatest monthly amount, 18.30, occurred at Laporte, Plumas County, while none fell at six stations in southern California.—*Alexander G. McAdie.*

Colorado.—The mean temperature was 46.4°, or nearly normal; the highest was 97°, at Holyoke on the 1st, and the lowest, 8° below zero at Lake Moraine on the 27th. The average precipitation was 1.76, or 0.66 above normal; the greatest monthly amount, 6.36, occurred at Parachute, while none fell at Hugo, and only a trace at Cheyenne Wells, Crook, Fox, Seibert, Springfield, and Wray.—*F. H. Brandenburg.*

Florida.—The mean temperature was 73.4°, or 1.5° above normal; the highest was 94°, at Clermont on the 6th, and the lowest, 49°, at De Funiak Springs on the 30th. The average precipitation was 6.10, or 2.30 above normal; the greatest monthly amount, 29.10, occurred at Sebastian, and the least, 0.97, at Stephensville.—*A. J. Mitchell.*

Georgia.—The mean temperature was 65.4°, or 1.3° above normal; the highest was 94°, at Jesup on the 19th, and the lowest, 31°, at Clayton on the 1st. The average precipitation was 3.89, or 1.73 above normal; the greatest monthly amount, 8.24, occurred at Marshallville, and the least, 0.74, at Adairsville.—*J. B. Marbury.*

Idaho.—The mean temperature was 43.3°, or 2.2° below normal; the highest was 90°, at Hagerman on the 5th, and the lowest, 4°, at Chesterfield and Van Wyck on the 10th and 12th, respectively. The average precipitation was 2.29, or 1.18 above normal; the greatest monthly amount, 5.48, occurred at Idaho City, and the least, 0.42, at Burnside.—*S. M. Blandford.*

Illinois.—The mean temperature was 59.4°, or 4.9° above normal; the highest was 94°, at Decatur and Plumhill on the 14th, and the lowest, 23°, at Scales Mound on the 29th and at Streator on the 31st. The average precipitation was 3.23, or 0.96 above normal; the greatest monthly amount, 5.26, occurred at Cisne, and the least, 1.08, at Scales Mound.

Fall seeding was completed, with about the usual acreage of wheat, rye, and grasses, except in central district, where less wheat than usual was sown, owing to the continued dry weather the first decade of the month. Wheat is generally reported to be in splendid condition.—*C. E. Linney.*

Indiana.—The mean temperature was 59.2°, or 5.6° above normal; the highest was 95°, at Washington on the 15th, and the lowest, 22°,

at Auburn, Cambridge City, and Fairmount on the 1st. The average precipitation was 2.91, or 0.54 above normal; the greatest monthly amount, 4.60, occurred at Syracuse, and the least, 1.25, at Hammond.

Wheat germinated well, and at the end of the month most of the fields were a bright green, the blades of the early sown being from 2 to 3 inches high, and the late sown just coming up, well prepared for winter weather.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 56.7°, or about 6.0° above normal; the highest was 95°, at Mooar on the 13th, and the lowest, 17°, at Hampton on the 29th. The average precipitation was 1.73, or about 0.75 below normal; the greatest monthly amount, 4.64, occurred at Thurman, and the least, 0.15, at Hamburg.—*J. R. Sage, Director; G. M. Chappel, Assistant.*

Kansas.—The mean temperature was 61.8°, or 5.4 above normal; the highest was 96°, at Colby on the 1st and at Toronto on the 15th, and the lowest, 18°, at Wallace on the 15th. The average precipitation was 1.75, or 0.15 below normal; the greatest monthly amount, 6.04, occurred at Campbell, while none fell at Norton and Oberlin.

Early sown wheat was growing rapidly at the end of the month and generally presented a fine stand; the late sown was coming up.—*T. B. Jennings.*

Kentucky.—The mean temperature was 61.3°, or 3.8° above normal; the highest was 93°, at Hopkinsville on the 13th and 14th, and the lowest, 26°, at Catlettsburg on the 1st. The average precipitation was 2.42, or nearly normal; the greatest monthly amount, 4.18, occurred at Earlington, and the least, 1.25, at Catlettsburg.

At the close of the month winter wheat had made a good start and was in a thriving condition; apparently about the usual acreage has been sown.—*H. B. Hersey.*

Louisiana.—The mean temperature was 70.0°, or 3.1° above normal; the highest was 94°, at Plain Dealing on the 13th, at Prevost on the 19th, and at Monroe on the 22d, and the lowest, 31°, at Robeline on the 30th. The average precipitation was 1.93, or 1.05 below normal; the greatest monthly amount, 4.86, occurred at Houma, and the least, 0.30, at Covington.—*W. T. Blythe.*

Maryland and Delaware.—The mean temperature was 57.6°, or 2.5° above normal; the highest was 88°, at Jewell, Md., on the 28th, and the lowest, 15°, at Deerpark, Md., on the 1st. The average precipitation was 2.80, or 0.24 below normal; the greatest monthly amount, 5.34, occurred at Millsboro, Del., and the least, 0.35, at Clearspring, Md.—*F. J. Walz.*

Michigan.—The mean temperature was 52.3°, or 4.6° above normal; the highest was 88°, at Berrien Springs on the 15th, and the lowest, 11°, at Mancelona on the 1st. The average precipitation was 2.95, or 0.25 above normal; the greatest monthly amount, 5.25, occurred at Vassar, and the least, 0.81, at Ludington. The month is distinguished by the two features of a high mean temperature and a small amount of snowfall; it is the warmest October of which this office has record (back to and including October, 1887). The snowfall was comparatively light in all parts of the State, especially over the Upper Peninsula, where an average of over 4 inches usually occurs during October, while this year there was only a trace.—*C. F. Schneider.*

Minnesota.—The mean temperature was 49.0°, or about 4.0° above normal; the highest was 87°, at Lake City on the 23d, and the lowest, 11°, at New Folden on the 19th. The average precipitation was 3.22, or 0.98 above normal; the greatest monthly amount, 7.95, occurred at St. Cloud, and the least, 1.05, at Minnesota City.—*T. S. Outram.*

Mississippi.—The mean temperature was 67.9°, or about 4.0° above normal; the highest was 96°, at Port Gibson on the 14th, and the lowest, 34°, at Batesville on the 1st and at Macon on the 2d. The average precipitation was 1.13, or 0.74 below normal; the greatest monthly amount, 2.42, occurred at Ripley, and the least, 0.27, at Brookhaven.—*H. E. Wilkinson.*

Missouri.—The mean temperature was 62.3°, or 6.5° above normal; the highest was 100°, at Appleton City on the 13th, and the lowest, 24°, at Elmira on the 17th. The average precipitation was 2.92, or 0.61 above normal; the greatest monthly amount, 6.33, occurred at New Madrid, and the least, 0.47, at Liberty.

In most of the eastern, central, and southern counties the weather during October was favorable for wheat sowing, and, although in some districts the soil was too dry for quick growth, as a rule the seed germinated well, and at the close of the month the crop looked very promising, but in many of the northern and western counties drought prevailed until the 25th; the soil was extremely dry; considerable seed failed to germinate, and some that came up died from lack of moisture. Over the greater portion of the State seeding was practically completed by the close of the month; pastures continued very dry and short, as a rule, but improved considerably after the rains of the 25–27th; there was also a scarcity of stock water in many places.—*A. E. Hackett.*

Montana.—The mean temperature was 41.3°, or 3.5° below normal; the highest was 87°, at Fort Benton on the 5th and 8th, and the lowest, 9° below zero, at Kipp on the 14th. The average precipitation was 1.47, or 0.59 above normal; the greatest monthly amount, 3.80, occurred at Dearborn Canyon, and the least, 0.40, at Red Lodge. The greatest total snowfall for the month was 35 inches at Dearborn Canyon. The storm of the 14th and 15th in north-central Montana and extending southward along the eastern slope of the Rocky Mountains was very severe; several sheep herders lost their lives and many thousand sheep were frozen to death.—*E. J. Glass.*

Nebraska.—The mean temperature was 53.0°, or 2.9° above normal; the highest was 98°, at Beaver on the 1st and at Tecumseh on the 23d, and the lowest, 11°, at Callaway on the 16th and at Gering on the 31st. The average precipitation was 1.00, or 0.54 below normal; the greatest monthly amount, 4.90, occurred at Eden, while none fell at a number of stations in the central and southwestern portions.

The dry, warm weather the first three weeks of October was exceptionally favorable for outstanding crops and for finishing fall work, with the exception of plowing and seeding. The soil was so dry during this period that very little plowing or seeding was done. Some wheat sown in September came up and was injured by this dry spell, while considerable seed remained in the ground and did not sprout, or came up unevenly, until the rains in the eastern part of the State on the 15th, 24th, and 25th. Warm weather followed these rains, and fall-sown grain improved in condition rapidly. Corn husking commenced unusually early, and although corn was broken down badly, rapid progress was made in securing the crop.—*G. A. Loveland.*

Nevada.—The mean temperature was 45.5°, or about 4.0° below normal; the highest was 89°, at Silver Peak on the 1st, and the lowest, 4°, at Fenelon on the 14th. The average precipitation was 0.74, or 0.22 above normal; the greatest monthly amount, 2.45, occurred at Lewers Ranch, while none fell at several stations.—*J. H. Smith.*

New England.—The mean temperature was 51.2°, or 3.1° above normal; the highest was 84°, at Waterbury, Conn., on the 12th and at Hawleyville, Conn., on the 13th, and the lowest, 14°, at Grafton, N. H., on the 22d. The average precipitation was 2.01, or 1.67 below normal; the greatest monthly amount, 3.99, occurred at Enosburg Falls, Vt., and the least, 0.70, at Jacksonville, Vt.

The weather during the month was especially favorable to outdoor work, and harvesting of crops and thrashing of grain progressed to a finish under the most suitable conditions. Plowing and seeding were completed in good season.—*J. W. Smith.*

New Jersey.—The mean temperature was 56.6°, or 3.3° above normal; the highest was 86°, at Friesburg on the 13th and the lowest, 18°, at Belvidere on the 22d. The average precipitation was 2.72, or 0.88 below normal; the greatest monthly amount, 4.65, occurred at Woodbine, and the least, 1.07, at Boonton.—*E. W. McGann.*

New Mexico.—The mean temperature was 53.3°, or 0.6° below normal; the highest was 90°, at Mesilla Park on the 1st, and the lowest, 7°, at Monero on the 27th and 28th. The average precipitation was 0.45, or 0.49 below normal; the greatest monthly amount, 2.30, occurred at Monero, while there was none recorded at Galisteo, Hillsboro, Lordsburg, Rincon, and Cambray, and only a trace at Albuquerque, Bernalillo, Deming, Los Lunas, White Oaks, and Strauss.—*R. M. Hardinge.*

New York.—The mean temperature was 52.5°, or 4.0° above normal; the highest was 86°, at Cedarhill on the 12th, and the lowest, 13°, at New Lisbon on the 22d. The average precipitation was 2.27, or 0.92 below normal; the greatest monthly amount, 4.48, occurred at North Lake, and the least, 0.24, at Mount Morris.

The weather has been favorable for all farm work and crops have been housed without material damage. While the month has been rather dry, the conditions have been favorable for the seeding and germination of fall grain; wheat and rye were very fine at the close of the month, with prospects of being strong and healthy at the beginning of the winter weather.—*R. G. Allen.*

North Carolina.—The mean temperature was 60.8°, or 1.2° above normal; the highest was 89°, at Tarboro on the 19th, and at Mocksville and Newbern on the 20th, and the lowest, 22°, at Linville on the 1st. The average precipitation was 4.31, or 0.62 above normal; the greatest monthly amount, 9.38, occurred at Hatteras, and the least, 1.01, at Biltmore.

The soil was in excellent condition for plowing, and winter grains germinated well and grew vigorously.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 42.0°, or 0.4° below normal; the highest was 86°, at Bismarck on the 6th and at Minot on the 1st, and the lowest, 7°, at Woodbridge on the 19th. The average precipitation was 1.14, or 0.18 above normal; the greatest monthly amount, 2.30, occurred at McKinney, and the least, trace, at Grafton.—*B. H. Bronson.*

Ohio.—The mean temperature was 57.4°, or 4.9° above normal; the highest was 94°, at Kenton on the 14th, and the lowest, 20°, at Wauseon on the 1st. The average precipitation was 2.14, or nearly normal; the greatest monthly amount, 4.50, occurred at Montpelier, and the least, 0.92, at Thurman.

The weather during the month was mild and pleasant, and generally favorable for all farm work. The condition of winter wheat at the end of the month, for the State as a whole, is not the best; a great many correspondents state that the dry weather prevented proper growth, and that many fields are thin and the plants weak.—*J. Warren Smith.*

Oklahoma.—The mean temperature was 65.9°, or 4.4 above normal; the highest was 99°, at Ryan on the 21st, and the lowest, 22°, at Woodward on the 31st. The average precipitation was 4.30; the greatest

monthly amount, 7.30, occurred at Tahlequah, and the least, 1.77, at Beaver.—*C. M. Strong.*

Oregon.—The most conspicuous features of the meteorological conditions of the month were the abnormally low temperatures prevailing in many sections and the excessive precipitation.

The mean temperature, 48.7°, was the lowest on record, being 2.4° below normal; the highest was 93°, at Vernonia on the 4th, and the lowest, 2° below zero, at Riverside on the 9th, being the first time on record that zero temperatures occurred during the month of October in Oregon. At many stations of the Willamette Valley and Plateau region the minimum temperature reached the lowest point ever recorded. The average precipitation was 4.42, which is 1.0 above normal; the greatest monthly amount, 11.32, occurred at Nehalem, and the least, 1.32, at Burns. The rainfall was evenly distributed throughout the month, falling in two well-defined periods, viz, from the 10th to the 12th and from the 15th to the 26th. Snow fell over the Plateau region on several days, the fall at Sparta in Union County being the heaviest on record in that section for October.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 54.6°, or 3.9° above normal; the highest was 94°, at Derry Station on the 16th, and the lowest, 15°, at Dushore and Hawley on the 22d. The average precipitation was 1.55, or 1.75 below normal; the greatest monthly amount, 3.81, occurred at St. Marys, and the least, 0.53, at West Newton.—*T. F. Townsend.*

South Carolina.—The mean temperature was 64.2°, or nearly normal; the highest was 91°, at Blackville on the 19th and at Temperance on the 21st, and the lowest, 34°, at Spartanburg on the 23d. The average precipitation was 5.00, or 1.90 above normal; the greatest monthly amount, 9.63, occurred at Blackville, and the least, 1.97, at Gaffney.—*J. W. Bauer.*

South Dakota.—The mean temperature was 48.4°, or about 1.0° above normal; the highest was 96°, at Cherry Creek (P. O. Leslie), on the 1st, and the lowest, 10°, at Ashcroft, on the 31st. The average precipitation was 1.53, or about 0.27 above normal; the greatest monthly amount, 4.41, occurred at Desmet, and the least, 0.43, at Cherry Creek.—*S. W. Glenn.*

Tennessee.—The mean temperature was 62.2°, or 3.9° above normal; the highest was 92°, at Iron City and Trenton on the 13th, and the lowest, 24°, at Silver Lake and Erasmus on the 1st. The average precipitation was 2.47, or 0.12 above normal; the greatest monthly amount, 4.27, occurred at Lynnville, and the least, 0.94, at Bluff City.

On the whole, the month was favorable for harvesting crops, preparing the soil, and sowing wheat; much of the early-sown grain was germinating well.—*H. C. Bate.*

Texas.—The mean temperature, determined by comparison of 43 stations distributed throughout the State, was 2.1° above normal. There was a slight deficiency over the extreme western portion of the State, while over the other portions there was a general excess, ranging from 1.0° to 4.4°, with the greatest over east Texas and the eastern portion of north Texas; the highest was 98°, at Panter on the 7th and at Grapevine on the 15th, and the lowest, 30°, at Marathon on the 27th and at Tulia on the 28th. The average precipitation, determined by comparison of 49 stations distributed throughout the State, was 1.35 above normal; there was a slight deficiency over the western portion of the State and the extreme eastern portion of the coast district, while there was a general excess elsewhere, ranging from 1.00 to 5.85, with the greatest excess over the central portion of the coast district. The rainfall for October was not well distributed throughout the State, and the number of rainy days ranged from none at Sanderson to 12 at Fort Brown and Fort Clark. The greatest monthly amount, 9.00, occurred at Brazoria, and the least, trace, at Sanderson.

The weather, as a whole, has been exceptionally favorable for cotton picking during the season, and the crop has been picked closer than it would have been had not the continued drought retarded other farm work, thus increasing the yield of the crop to some extent. The top crop of cotton was generally a failure. The yield of the cotton crop is light, except in a few scattered localities, and, as a whole, is considerably below an average.—*I. M. Cline.*

Utah.—The mean temperature was 45.6°, or 2.8° below normal; the highest was 96°, at Pahreah on the 5th, and the lowest, 9°, at Woodruff on the 8th. The average precipitation was 1.50, or 0.66 above normal; the greatest monthly amount, 3.86, occurred at Huntsville, and the least, 0.06, at Elgin.—*L. H. Murdoch.*

Virginia.—The mean temperature was 58.5°, or 0.8° above normal; the highest was 88°, at Bigstone Gap on the 15th, and the lowest, 20°, at Burkes Garden on the 1st. The average precipitation was 2.97, or 0.24 below normal; the greatest monthly amount, 6.11, occurred at Callaville, and the least, 0.89, at Cliftonforge.—*E. A. Evans.*

Washington.—The mean temperature was 48.6°, or more than 1.0° below normal; the highest was 86°, at Southbend on the 4th and the lowest, 13°, at Cle Elum on the 14th. The average precipitation was 3.95, which is over an inch above normal. In the eastern section the precipitation was double the normal amount. The greatest monthly amount, 13.73, occurred at Clearwater, and the least, 0.39, at Connell.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 56.8°, or 2.8° above normal; the highest was 91°, at New Cumberland on the 5th, and the lowest, 19°, at Marlinton on the 1st. The average precipitation was 1.39, or 0.99 below normal; the greatest monthly amount, 3.81, occurred at Lanes Bottom, and the least, 0.23, at Powellton. Droughty conditions prevailed during the greater portion of the month; forest fires, which were very destructive to timber, were general over the eastern and central counties; wheat and oats are coming up very slowly, but look fairly well.—*E. C. Vose.*

Wisconsin.—The mean temperature was 52.1°, or about 3.6° above normal; the highest was 88°, at Prairie du Chien on the 23d, and the lowest, 15°, at Spooner on the 21st. Remarkably high temperatures were recorded in all portions of the State from the 22d to the 24th, the record for the last decade of October being broken at nearly all stations. The average precipitation was 2.50, or about normal; the rainfall was heaviest in the north-central counties, the greatest amount being 6.53 at Hayward, 3.69 of which fell in fourteen hours on the 14th and 15th; the least amount for the month was 1.04, at Valley Junction.

The dry weather during the latter part of September and the early part of October seriously interfered with plowing and seeding and rendered the germination of fall grains extremely slow. The droughty condition was broken, however, by the occurrence of liberal and well distributed rains from the 10th to the 16th, and pastures were revived and fall grains were greatly improved.—*W. M. Wilson.*

Wyoming.—The mean temperature was 40.6°, or 3.6° below normal; the highest was 91°, at Fort Laramie on the 1st, and the lowest, 1° below zero, at Fourbear on the 13th. The average precipitation was 1.54, or 0.70 above normal; the greatest monthly amount, 4.81, (47.6 inches of snow), occurred at Centennial, and the least, 0.35, at Lovell.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

EFFECT OF WIND ON CATCH OF RAINFALL.

By G. J. SYMONS, dated London, October 24, 1899.

I desire to say a few words respecting the interesting article under the above title, on pages 308–310 of the MONTHLY WEATHER REVIEW for July, 1899.[1]

As regards the gages at Sacramento, the railroad gage must be of a very bad pattern if it really loses anything of consequence by evaporation. I have no idea what the pattern is, but assuming it to be fairly correct, I have no doubt that its deficit is due to its location "so placed on the roof, near the south end of the building that the wind strikes it with greater velocity than at almost any other location that could have been chosen." Now, if the reader will turn to the article, by the late George Dines in British Rainfall, 1877, pp. 15–25, he will see that this position is apparently precisely that in which the minimum of rain will be collected. While quite approving the suggestion that a shielded gage be established close to the offender, I would also suggest that, if the buildings permit, it would be well to put an unprotected gage 20 or 30 feet to leeward of the present one—according to Mr. Dines' experiments this should collect far more than the old gage.

I wish also to correct an erroneous impression that might be made by reading the paragraph at the top of the second

[1] In reference to the above important letter from Mr. Symons, we may say that when, on page 309, second column, lines 7 and 8, we stated that the pit gage is adopted as the standard in England and Europe, we had in mind those who have investigated the decrease of rainfall with altitude; in such studies the pit gage is considered to have its mouth at the level of the ground, or at altitude 0. It is only for such special researches that Mr. Symons encourages its use. For ordinary use at his thousands of rainfall stations, Mr. Symons always requires an altitude of 1 foot. In this matter, where uniformity is the main point, he is undoubtedly correct. On the average of all the investigations that have been made in Europe and America, it results that the difference between the pit gage and one established at an elevation of 1 foot, or the so-called deficit of the upper gage is between 3 and 4 per cent. In order that the reader may fully appreciate the reliability of this statement we reprint a large portion of the Editor's paper read before the Philosophical Society of Washington, November 24, 1888.—ED.

column, on page 309. We do *not* use pit gages in ordinary work; they have only been used in several cases at stations at which experiments were in progress as to the decrease in the amount collected at different altitudes, but they have never been used at ordinary rainfall stations. Our standard gages have their orifices 1 foot above the natural level of the soil; there is no pit and no protection. An engraving illustrating this matter is given in the "Instructions to Observers," at the end of nearly every annual volume of British Rainfall. We adopted 1 foot chiefly to avoid in-splashing from surrounding soil. Every one did not surround his gage with grass, and we found garden mould in the bottles.

I heartily endorse the Editor's remarks as to the evil of moving old-established gages. Observers little know the harm that they may thus do.

I would plead for the establishment, in the United States, of more gages at, or near, the ground level. In Great Britain the rainfall records are largely used by engineers, they want to know what reaches the ground, not what can be caught on a roof 100 feet above it. Cannot the Weather Bureau secure such records in parks within cities and at agricultural stations. Will not the MONTHLY WEATHER REVIEW and the annual reports indicate which records belong to gages on the roofs and which to those on the ground, as this distinction is one of great importance?

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for October, 1899.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Culiacàn Rosales (E d. S.)	112	29.69	97.7	63.5	81.9	57	0.69	ne.	ne.
Durango (Seminario)	6,243	24.05	87.8	43.2	64.2	59	2.12	sw.	e.
Leon (Guanajuato)	5,934	24.31	82.2	37.2	61.4	62	1.18	sse.	se.
Mexico (Obs. Cent,)	7,472	23.08	78.1	37.0	59.9	64	0.81	n.	ne.
Morelia (Seminario)	6,401	23.98	79.3	43.7	56.7	77	1.88	w	w.
Puebla (Col. Cat,)	7,112	23.38	78.4	39.7	63.1	84	2.29	ene.	nw.
Saltillo (Col. S. Juan)	5,399	26.39	78.1	44.6	65.5	80	5.79	s.	sw.
San Isidro (Hac. de Guanajuato)	.....	.....	83.8	59.9	.....	.....	2.61	.....	.....
Silao	6,063	24.28	77.9	47.3	66.7	62	1.44	ese.	w.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made partly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

Meteorological observations at Honolulu, October, 1899.

The station is at 21° 18′ N., 157° 50′ W.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, −0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours has always been measured at 7:30 p. m., not 1 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m., Greenwich time, or 2:30 a. m., Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.98	73	69.5	83	70	65.7	72	ne.	3	4	30.04	29.95	0.03
2	29.96	75	69	84	73	67.7	72	ne.	1-3	6	30.02	29.93	0.00
3	29.98	74	71	85	75	66.7	67	ene.	3	4	30.05	29.95	0.08
4	30.02	75	68.5	83	73	68.0	72	ne.	4	3	30.08	29.98	0.01
5	30 05	75	68	84	75	65.0	64	ne.	4	1	30.08	29.99	0.00
6	30.04	74	67	84	75	63 5	62	ne.	3	1	30.09	30.00	0.00
7	29.98	74	67	83	74	64 0	64	ene.	3	5	30.06	29.95	0.00
8	29.91	70	67	84	73	65.5	69	se-sw.	1	3-8	29 97	29.89	0.00
9	29.91	70	65	82	68	67.0	78	s.	1	4-8-0	29.95	29.87	0.00
10	29.92	73	67	85	64	63.5	64	e.	1-3	1	29.93	29.88	0.00
11	29.88	71	66.5	83	70	62.5	63	e-n.	1	7-2	29.95	29.85	0.00
12	29.85	72	69.5	83	71	65-3	70	se.	2	4-10	29.93	29.85	0.12
13	29.87	74	72	77	71	70.0	86	e-s.	3	10	29.94	29.81	0.06
14	29.94	71	69.5	83	74	70.3	82	s.	2	10-3	29.98	29.89	0.00
15	29.93	75	69	85	71	68.0	73	e-ne.	3-0	5	29.99	29.90	0.00
16	29.96	75	66.5	84	75	65.7	66	e-ne.	1-3	3	30.00	29.91	0.00
17	30.00	75	66.5	83	74	63.7	61	ne.	3-6	4	30.03	29.94	0.04
18	30.00	73	67.5	82	71	63.7	61	ne.	5-6	4	30.07	29.97	0.40
19	29.91	70	67.5	79	70	65.5	72	ene.	4 2	8	30.03	29.91	0.70
20	29.87	71	68.5	79	69	65.0	74	nne.	2	8	29.97	29.87	0.38
21	29.87	72	70	77	70	68.0	82	nne.	2-4	8	29.93	29.85	1.40
22	29.93	74	68.5	77	70	69.0	85	ne.	6-2	5	29.97	29.87	0.19
23	29.95	74	68	80	71	65.7	70	ne.		3	4	30.00	29.91	0.01
24	29.97	74	66.5	81	73	65.0	67	ne.		4	4-8	30.03	29.93	0.00
25	29.95	74	69	79	71	62.5	64	ne.		2	5	30.02	29.95	0.10
26	30.02	75	67	78	72	67.0	75	ne		6-2	8	30.04	29.94	0.08
27	30.06	74	66	80	73	64.0	65	ene.		6-2	8	30.10	30.00	0.07
28	30.04	72	65 5	80	72	61.7	63	ene.		5	8	30.11	30.03	0.05
29	30.01	72	65.5	78	69	62.0	65	ne.		4	6-3	30.08	29.98	0.00
30	29.99	69	67	80	72	63.5	65	ne.		3	3	30.04	29.94	0.02
31	30.00	69	65.5	78	68	65.0	78	ne-n.		1-0	8	30.05	29.95	0.28
Sums.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.02
Means.	29.96	72-9	67.5	81.4	71.5	65.5	70.7	.....	2.9	5.5	30.02	29.92	....
Departure.	+0.05	.....	.....	.....	.....	−0.7	−1.0	.....	.....	+1.2	.....	.....	.....	+1.56

Mean temperature for October, 1899 (6+2+9), +3=75.7°; normal is 76.3°. Mean pressure for October (9+3)+2=29.971; normal is 29.966.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4:30 p. m., Greenwich time. ‡These values are the means of (6+9+2+9)+4. §Beaufort scale.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently arrived in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Das Wetter. Berlin. 16 *Jahrgang.*

Bebber, von, W. J. Wissenschaftliche Grundlage einer Wettervorhersage auf mehrere Tage voraus, insbesondere im Interesse der Landwirthschaft. P. 217.

Meinardus. W. Ueber die Nothwendigkeit hydrographischer Studien im nordatlantischen Ocean zum Verständniss der meteorologischen Erscheinungen im nordalpinen Europa. P. 222.

Davis, W. M. Die Cirkulation der Atmosphäre. (Fortsetzung.) P. 228.

Weise, — Wolkenbildung, Regen und Wald. (Schluss.) P. 233.

Philosophical Magazine. London. Vol. 48.

Chattock, A. P. Velocity and Mass of the Ions in the Electirc Wind in the Air. P. 401.

Bulletin American Geographical Society. New York. Vol. 31.

Ward, R. De C. Acclimatization of the White Man in the Tropics. P. 367.

Electrical World and Engineer New York. Vol. 34.
Kennelly, A. E. A Multiple Lightning Flash. P. 651.
Thomson, Elihu. Multiple Flashes and Dark Flashes of Lightning. P. 738.
Ciel et Terre. Bruxelles. 20me Année.
Arrhenius, S. Les oscillations séculaires de la température á la surface du globe terrestre. P. 389 and p. 411.
Scottish Geographical Magazine. Edinburgh. Vol. 15.
—— The Tianshan: [Its] Climate. P. 593.
Science. New York. Vol. 10.
Wood, R. W. On the cause of Dark Lightning and the Clayden Effect. P. 717.
American Journal of Science. New Haven. 4 *ser. Vol.* 8.
Fassig, O. L. Types of March Weather in the United States. P. 319.
Naturwissenschaftliche Rundschau. Braunschweig. 14 *Jahr.*
Teisserenc de Bort. Ueber die Temperatur in der freie Atmosphäre und deren Aenderungen, nach den Beobachtungen von 90 Sonden Balloons. (Comptes Rendus, 1899.) P. 532.
Journal of Geology. Chicago. Vol. 7.
Chamberlin, T. C. An attempt to frame a working Hypothesis of the cause of Glacial Periods on an Atmospheric Basis. P. 545.
Tolman, C. F. Carbon Dioxide of the Ocean and its relation to the Carbon Dioxide of the Atmosphere. P. 585.
Sitzungsberichte der K. Preuss. Akademie der Wissenschaften. Berlin. 1899.
Warburg, E. Ueber positive und negative Spitzenentladung in reinen Gasen. P. 770.
L'Aerophile. Paris. 7me année.
Farman, M. De Paris au golfe de Fos en ballon. [Meteorological Observations, etc.] P. 111.
Zeitschrift für Luftschiffahrt und Physik der Atmosphäre. Berlin. 18 *Jahr.*
Herring, A. M. Die Regulirung von Flugmaschinen. P. 206.
Mertens. Ueber die Hohenkrankheit. P. 221.
Tuma, J. Beiträge zur Kenntniss der atmosphärischen Elektricität. P. 233.
Annalen der Physik und Chemie. Leipzig. N. f. Band 69.
Wolff, W. Ueber die bei Explosionen in der Luft eingeleiten Vorgänge. P. 329.
Emdem, R. Ueber den Luftwiderstand fliegender Geschosse. P. 454.
Hirsch, R., v. Dichtebestimmungen von gesättigten Dämpfen und Flüssigkeiten. P. 456.
Fomm, L. Elektrische Abbildungen. P. 479.
Heydweiller, A. Bewegte Körper im elektrische Felde und über die elektrische Leitfähigkeit der atmosphärischen Luft. P. 531.
Nature. London. Vol. 60.
Bidwell, Shelford. Dark Lightning Flashes. P. 591.
—— Meeting of the Meteorological Committee.
Meteorologische Zeitschrift. Wien. Band 16.
Tabert, W. Die Bildung des Hagels. P. 433.
Jensen, Chr. Beiträge zur Photometrie des Himmels. P. 447.
Hann, J. Der tägliche Gang der Windgeschwindigkeit auf dem Wasserthurme und auf der Münster-Thurmspitze in Strassburg. P. 457.
J. Hann. Klima von Salta, Argentinien. 466.
J. Hann. Klima von Villa Maria. P. 468.
J. Hann. Vorlaüfige Ergebnisse der meteorologischen Beobachtungen des belgischen antarktischen Expedition. P. 472 und 474.
Wild, H. Ueber Normalthermometer. P. 462.
Willaume-Jantzen, V. Klima des Farör. P. 464.
Buehrer, C., und Dufour, H. Aktinometer-Beobachtungen. P. 465.
Koenig, H. Dauer des Sonnenscheins (in Stunden, Ortszeit) in Hamburg, 1898. P. 468.
Buehler, Ebermayer, Hoppe, Muettrich. Untersuchungen über den Einfluss des Waldes auf den Stand des Gewässer. P. 469.
MacDowell, Alex. B. Sonnenflecken-Periode und Frosttage in Frankreich. P. 473.
Ricco. Die Temperatur bei Ætna-Observatorium. P. 473.
—— Zum Klima von Ostgrönland. P. 474.
Schelle, E. Bemerkenswerthe Blitzformen. P. 475.
Supan. Ueberschwemmung in der Sahara. P. 476.
Moeller, M. Berichtigung. P. 476.
Wolfer, A. Provisorische Sonnenflecken-Relativzahlen für das dritte Quartal, 1899. P. 476.

DESCRIPTION OF A NEW BRASS RIVER GAGE AT RICHMOND, VA., AND ITS METHOD OF SUPPORT.

By O. D. LEISENRING, Observer, U. S. Weather Bureau.

During a severe flood in February, 1899, when heavy ice moved out of the James River with exceptional violence and gorged in constricted parts of the channel, the wooden river gage of the Weather Bureau at Richmond, Va., was seriously damaged and in due time the erection of a brass gage to replace it was authorized. Some peculiar features attach to the exposure of this gage, and they rendered the manner of its erection a subject for serious consideration. A method was finally devised which, although somewhat novel, was approved by the Chief of the Weather Bureau, and the work has been performed in accordance with it. In the hope that some suggestion valuable to others may be derived from it, this brief description of the plan is prepared.

Many small rocky islets dot the falls of the James River at Richmond, and a larger island, with a soil formation superposed, closes the group and extends into the tidewater below. The Richmond and Danville Railroad Company owns the land abutting on the mainland bank of the east channel, and has protected it with a retaining wall of granite masonry about 27 feet high. The old gage, located as nearly as possible at the foot of the falls, was attached in a vertical position to the face of this wall by iron holdfasts. Since the batter of the wall is nearly 3 feet, it follows that the gage stood off from the wall that distance at its top and proportional distances all the way down to zero. This construction gave rise to the danger of drift and floating ice wedging between the wall and the gage and damaging or destroying the latter. The danger was augmented by the constriction of the channel at this point, and by the increased rapidity of flow in times of high water. It was therefore considered that in erecting a new gage of material practically imperishable care ought to be taken to protect it from the possibility of destruction by violence. Two methods of accomplishing this result were at first considered: one by cutting a flaring recess in the face of the wall, having at its back a plumb surface of sufficient width for attaching the gage; and the other by making a shallow channel down the face of the wall, deep enough only to develop a plane surface throughout and to afford protection to the brass scale. Both of these methods were objectionable. The former as to cost, uncertainty about the thickness of the wall near its base, and the probable deposits of sediment and debris in the lower part of the recess; the latter because the gage would thus have an inclination with the face of the wall, and its readings would require a correction to be applied whenever they exceeded 3 feet or thereabout. The suggestion to attach a buttress of cement concrete to the wall, and to mount the gage on its plumb face, was finally considered and adopted.

This buttress has the shape of an inverted wedge of trapezoidal cross section. The thin end is recessed in the wall and is of sufficient thickness to be stable, and to hold the expansion bolts for fastening the gage. Thence it rises with its plumb face of uniform width (about 24 inches) to the height required, its inclined face resting on the wall and widening as it rises, and its sides forming up in the flaring triangular figures thus developed. It thus presents, at any stage of water, either a surface flush with the wall, or a projecting configuration well adapted to deflect or to resist the impact of any floating body. Probably few floating objects, save pack ice, will ever touch it, owing to the deflection of the carrying current by dead water before reaching the buttress.

The method of construction was as follows: The surface of the wall to be covered by the buttress was cleaned and all loose mortar and spalls scraped from the joints of the masonry. Holes were drilled for a row of anchor bolts spaced two feet vertically, and located alternately on each side of the gage seat. These bolts are of $\frac{1}{2}$ inch iron, and extend to 6 inches from the plumb face. Some extra anchors were inserted in convenient open joints of the masonry, and all were set in neat Portland cement. A mould was erected consisting of two heavy planks placed vertically, and securely

stayed to form the front of the buttress. On the inner side of these planks was placed a template of the gage, having fixed in it wooden pegs of proper size, and so spaced as to form holes for the expansion nuts of the holding on bolts. The template itself moulded the recess for the brass scale. On the inner side of the heavy planks, and on the downstream side of the template, the right-hand side as one reads it, wood figures sawn from ¼-inch stuff, were tacked to form indented figures in the concrete face opposite the foot marks. The space to be occupied by the buttress was then boxed in as the work of filling progressed, with short horizontal boards, extending from the edges of the vertical planks to the face of the wall and flaring with angles of 45°. Portland cement concrete of about the character used in the best cement walks and curbs, constituted the filling. Next to the wall the mix was of fine gravel, and strong mortar was freely used in flushing into the joints and interstices of the wall, and in forming the bond with its face. The work was carried up in comparatively thin sections to give opportunity for the setting of the cement, and two weeks were allowed for hardening after the completion of the filling, before the mould was removed. The brass scale was then bolted in, and the surfaces were smoothly troweled with neat cement.

The weight of this structure is about 22,000 pounds, and the holding surface, that is, the area of the bond between buttress and wall, approximately 16,000 square inches, so that even with indifferent construction the work would be reasonably secure. With good construction and the addition of anchor bolts, its permanence can not be doubted, and may be held to depend only upon the stability of the supporting wall.

THE CLIMATE OF ST. LAWRENCE ISLAND.

By Mr. A. J. HENRY, Chief of Division.

St. Lawrence, the largest island in Bering Sea, is situated in latitude 64° N., longitude 170° W. It is about 400 miles north of the well-known Pribilof group and about 200 miles south of the Arctic Circle. The nearest land, the Siberian coast, is a little less than 100 miles distant.

The Presbyterian Board of Home Missions built a schoolhouse in the Eskimo village of Chib-u-Chak (Gambell) on the extreme northwest corner of the island in 1891, but it was impossible to secure a teacher until some years later. The first teacher secured by the board, Mr. V. C. Gambell, kindly consented to make meteorological observations while on the island. He began observing in October, 1894, and continued until September, 1897. Mr. W. F. Doty succeeded him as observer in November, 1898, observing regularly until he left the island in June, 1899.

Mr. Gambell was supplied by the Weather Bureau with standard self-registering thermometers and a rain gage. He did not succeed in measuring the precipitation, but we are indebted to him for a valuable series of temperature observations, which we have summarized in the accompanying tables. Mr. Gambell's record has been supplemented by the observations made for eight months by Mr. Doty. The latter did not have self-registering maximum and minimum thermometers, but it is evident from the observed extremes he has furnished that he kept close watch on the thermometer. In transmitting his observations to the Central Office, Mr. Doty writes as follows:

I have the honor to transmit herewith some meteorological observations made by me at Gambell, St. Lawrence Island, extending from November 1, 1898, through to July 11, 1899. The thermometer used was a Fahrenheit, and I fancy was quite accurate. It was not provided with an automatic register. Observations were made three times a day. I did not have a barometer, a rain or snow gage, or any instrument to gage the velocity of the wind. I guessed at the force of the wind and found that one of the whaling captains confirmed my estimate of the strength of a gale in the late spring, and believe that, as a rule, I did not overestimate. The maximum and minimum thermometers were out of order and so could not be used. It was quite impossible to estimate the depth of snowfall, as the wind blows the snow into the air from the ground, while it is snowing and the snow is piled into great drifts in places and carried off elsewhere. A question mark has been placed in the column for the record of snowfall to designate that snow fell on that day.

Before taking observations daily I observed the thermometer from time to time during October and noticed a very gradual lowering of the temperature during the month. I fancy that this steadiness during the latter part of September and October was remarkable in contrast with the change from day to day in the winter. The spring greatly resembled the fall in this respect, save that of course the temperature rose.

* * * * * * *

Temperatures observed at Gambell, St. Lawrence Island, Alaska (latitude, 63° 34′ N.; longitude, 171° 45′ W.)

MONTHLY MEAN TEMPERATURES (Max. + Min.) ÷ 2.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1894	.....	.....	.....	.....	.....	.....	.....	.....	.....	27.5	19.3	5.9
1895	4.2	— 8.0	0.6	14.8	28.8	37.6	43.6	42.8	38.3	27.3	21.9	1.3
1896	2.8	—12.8	1.4	16.4	22.4	34.7	42.7	41.7	36.4	30.0	28.5	6.5
1897	5.0	3.4	—3.4	12.5	29.4	37.9	45.5	46.8	38.6	.....	.....	.....
1898	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	23.8	7.3
1899	6.3	6.8	14.5	14.9	31.5	36.5	.....	.....	.....	.....	.....	.....
Means	4.6	—2.6	3.3	14.6	28.0	36.7	43.9	43.6	37.8	28.3	23.4	5.2

MAXIMUM TEMPERATURES.

1894	.....	.....	.....	.....	.....	.....	.....	.....	.....	42	34	33
1895	28	14	32	37	45	48	59	59	50	42	36	30
1896	29	25	35	38	35	45	54	51	48	39	35	30
1897	31	33	33	34	44	62	58	57	50	.....	.....	.....
1898	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34*	31
1899	30	35	35	42	38	46	....	.....	.....	.....	.....	.....
Extremes	31	35	35	42	45	62	59	59	50	42	36	33

MINIMUM TEMPERATURES.

1894	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	5	—18
1895	—21	—31	—23	—18	12	27	34	34	23	18	0	—25
1896	—18	—25	—29	— 6	3	26	30	32	21	16	16	—17
1897	—15	—22	—31	— 9	17	26	33	36	29	.....	.....	.....
1898	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8*	—19
1899	—20	—10	—16	0	18	30	.....	.....	.....	.....	.....	.....
Extremes	—21	—31	—31	—18	3	26	30	32	21	15	0	—25

* Observed readings November, 1898, to June, 1899.

Miscellaneous data for Gambell, St. Lawrence Island, Alaska.

Weather and wind.	1898.		1899.						
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
Clear days	1	8	11	12	8	4	3	0	1
Partly cloudy days	4	6	11	8	3	5	7	4	4
Cloudy and foggy days	25	17	9	8	20	21	21	26	6
Prevailing winds	ne.	ne.	ne.	e.	ne.	ne.	e.	sw.	sw.
Number of times observed from—									
North	2	10	17	8	3	6	11	2	.....
North-northeast	4	.....	.....	.....	.....	.....	.....	.....	.....
Northeast	34	34	39	15	29	47	21	3	5
East-northeast	4	.....	.....	1	1	1	.....	.....	.....
East	23	22	1	29	2	9	29	3	1
East-southeast	1	.....	.....	.....	.....	.....	.....	.....	.....
Southeast	2	10	4	7	17	7	4	.....	1
South-southeast	.....	.....	.....	.....	3	1	1	.....	.....
South	4	2	21	5	8	5	3	3	6
South-southwest	.....	.....	.....	.....	.....	.....	6	2	1
Southwest	5	2	.....	.....	16	2	3	39	11
West-southwest	.....	.....	.....	.....	.....	.....	.....	3	.....
West	.....	.....	.....	2	1	5	.....	27	4
West-northwest	.....	.....	.....	.....	.....	.....	.....	.....	.....
Northwest	7	.....	3	.....	1	.....	3	1	.....
North-northwest	1	.....	.....	.....	.....	.....	.....	.....	.....

NOTE.—Out of a possible 664 observations the wind was observed to be northeast 227 times, giving an approximate percentage of 34; east wind, 119 times, approximate per cent, 18; this leaves 308 possibilities for all the other 14 directions, or 48 per cent. In the table the data for

July covers 11 days only. The scale of wind force is as follows: 6=gale, or 45 miles per hour; 7=strong gale or 60 miles per hour, and 8=violent gale, or 75 miles per hour. Fog has been regarded as 10 on the scale of clouds. Observe that there was a vast deal of cloudy or foggy weather in March, April, May, June, and July. In June there was not a clear day. The cold in winter is keenly felt because of the high winds and by reason of the moisture in the air—there are open places in the ice.

THE SLUGGISHNESS OF THERMOMETERS.

By C. F. MARVIN, Professor of Meteorology.

When a thermometer is placed in a medium, the temperature of which is not the same as that of the thermometer, an interchange of heat immediately sets in and presently the thermometer and the medium take on the same temperature. A sluggish thermometer will be slow to arrive at the temperature of the medium, whereas a sensitive thermometer will take this temperature much more quickly. The foregoing brings out the significance of the words sluggish and sensitive in the present connection, and, in what follows, methods will be described by which these qualities or properties of thermometers may be measured, and the results applied in estimating the accuracy of the observations obtained by the use of a given instrument to measure the temperature of a medium, especially when this temperature changes more or less rapidly.

It is obvious that if the temperature of the medium changes quickly, and more or less continuously, there will be a "lag" in the indications of the thermometer, depending upon its sluggishness and the rapidity with which the temperature continues to change; that is, the temperature indicated by the thermometer at a given moment of time will be a temperature experienced by the medium several moments before. In other words, the temperature of the thermometer will be a certain amount higher or lower than that of the medium, and the discrepancy will persist as long as the temperature of the medium continues to change in the same sense. This lag is especially marked when more or less sluggish thermometers and thermographs are used in the measurement and registration of the temperature of the air, since the latter has but a small capacity of carrying heat to or away from a thermometer bulb. Whenever it is practicable to do so, therefore, the air whose temperature is desired, is passed in a strong current over the bulb of the thermometer, or the thermometer itself is whirled through the air at a comparatively rapid rate; both accomplish the object of bringing the thermometer quickly to the temperature of the air, or, if the air temperature is changing, of reducing the error due to sluggishness to the minimum.

The effects of sluggishness are illustrated perhaps more strikingly in the accompanying diagram, Fig. 1. First let us suppose a thermometer to be quickly plunged into cold air of a constant temperature, represented on the diagram by the line *T T*. Owing to its sluggishness the thermometer does not instantly take on the temperature of the air, but reaches it gradually after a series of changes, such as represented by the curve t_1 t_2, for example. If, however, the temperature of the air changes steadily, the thermometer either does not acquire the temperature at all, or assumes it momentarily only to lag behind afterward, as shown in the diagram, where d and d' indicate the errors in the indications of the thermometer due to sluggishness, when the temperature changes uniformly. The error is larger the more sluggish the thermometer and the more rapid the rate of change in air temperature.

Effects of ventilation.—When the circulation of the air about the bulb of a thermometer is so rapid that the surface of the bulb is maintained at sensibly the same temperature as that of the air, the thermometer will then exhibit its maximum sensitiveness, and no increase in the rapidity of circulation will further affect the sensitiveness. The sluggishness in such cases has to do wholly with the flow of heat in the interior of the bulb and the movement of the mercury in the narrow bore of the tube. When, however, the temperature of the exterior surface of the bulb is not maintained at the same point as that of the medium as a whole, then we may consider that portions of the medium stagnate, as it were, about the thermometer and prevent the free escape of heat from the bulb, or its access thereto, as the case may be. The apparent sluggishness under these circumstances may be very considerable, and differs according to the degree of circulation. The degree of ventilation required to secure the maximum sensitiveness is hardly known, but for air it is doubtless very considerable, whereas for thermometers plunged in water, for example, it is probable that, under moderate agitation, the extreme surface of the bulb is sensibly at the same temperature as that of the liquid.

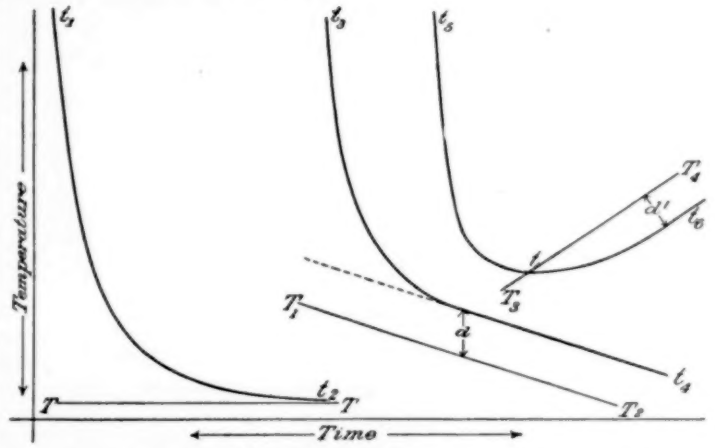

FIG. 1.—Curves illustrating sluggishness of thermometers.

t_1 t_2 temperature curve of a warm thermometer placed in a colder medium whose temperature remains constant.
t_3 t_4 temperature curve for a warm thermometer in a colder medium whose temperature steadily falls. The temperature of the thermometer continues d units higher than that of the medium.
t_5 t_6 temperature curve for a warm thermometer in a colder medium whose temperature steadily rises. At t the temperature of the thermometer and the medium are momentarily the same and the curve is horizontal, but owing to its sluggishness the thermometer presently thereafter indicates a temperature d' units too low.

According to the accepted theory of the flow of heat under these circumstances, it is assumed that the rate at which the thermometer will change its temperature at any given instant is proportional to the difference between its temperature at the moment and that of the ambient medium. In order to express this in the form of an equation—

Let U = the temperature of the air at any moment.

Let u = the corresponding temperature indicated by the thermometer.

Then, the momentary rate at which the thermometer changes its indications will be

$$\text{Rate} = r = k\,(U - u) = \frac{du}{dt}$$

In which k is a coefficient of sensitiveness to be determined by experiment. The greater the value of k the more sensitive the thermometer.

This equation is one of the most convenient for computing the value of k from experiments, especially when the thermometer traces its own record, as in the case of thermographs recording on sheets moving at a comparatively rapid rate.

When thermographs are sent up into the free air on balloons, kites, etc., which generally pass more or less quickly through strata of air having successively different tempera-

tures, it is highly desirable that the instruments should be as sensitive as possible, but it is quite as important that the errors due to sluggishness, whatever they are, be more or less carefully determined. For this purpose the writer made, during February, 1899, a large number of experiments with the thermographs that had been employed by the Weather Bureau during the summer of 1898, in procuring temperature data in the free air by means of kites.

The meteorograph, which in addition to temperature, records also the velocity of the wind, the humidity and pressure of the air, is shown in Fig. 2, Plate I. The thermometer is the part with which we are now especially concerned. What corresponds to the bulb of this is made compound, in order to secure greater sensitiveness, and is shown separately in Fig. 3, Plate I. It consists of two small Bourdon pressure tubes coupled together, side by side. This compound bulb is mounted in a concentric position, nearly in the middle of the cylindrical tube seen at the top portion of the picture of the meteorograph, Fig. 2. When so mounted, one end of the bulb, *a*, Fig. 3, is adjustably fastened to the cylindrical tube; the other end, *b*, Fig. 3, is connected by suitable linkages to the second recording pen from the left, as seen in Fig. 2. Thus arranged, the pen moves laterally over a portion of the record sheet according to changes taking place in the temperature of the bulb. The pressure tubes composing the bulb are made of very thin, hardened, and highly elastic steel. In the process of filling, the ends of the bulbs are first spread apart a certain distance, and, while in this strained condition, pure alcohol or ether is introduced until the bulbs are completely filled, every bubble of air being carefully excluded. The tubulure is then closed and hermetically sealed. When the spreader is taken out from between the ends of the tubes, the latter tend to resume their normal distance, but, are prevented from doing so by the liquid, within. Every change in the volume of the liquid, with change of temperature, is thereafter accompanied by a corresponding movement of the free end of the tube. This motion, suitably magnified and recorded, suffices to indicate and record the temperature of the bulb. The meteorograph is so attached to the kite that throughout an ascension the wind blows with full force through the tube containing the thermometer bulb, thereby securing the greatest possible circulation of the air around the bulb, which, at the same time, is fully screened from direct radiation.

The instrument is designed primarily to measure and record the temperature of a *current* of air in which it is placed. Special precautions are taken to cut off radiation and to prevent loss or gain of heat by conduction to or from the remaining metalic parts of the instrument. Under these circumstances, if the air is prevented from circulating freely through the tube enclosing the thermometer bulb, there is so little opportunity for the bulb to change its temperature that seemingly the instrument is very sluggish. This characteristic was brought out in the first experiment made. Meteorograph No. 1, after having acquired the temperature of the room (70° F.), was quickly placed outdoors in front of a small electric fan which forced the air in a moderately strong current over the thermometer bulb. The circulation was judged to be equivalent to that during an average kite ascension. After about three minutes exposure the thermometer had reached the temperature of the air (30° F.). The instrument was then returned quickly to the room, but not subjected to any artificial ventilation whatever. At the end of thirty-seven minutes the instrument recorded 68° with a slight rising tendency. The apparent extreme sluggishness in this case is due to the stagnation of the air near the bulb of the thermometer.

In order to measure accurately the sluggishness of these instruments a number of experiments similar to the above were made, that is, the instrument was moved quickly from a warm room to the cold outside air and vice versa, the recording pen tracing its record of the change of temperature automatically on the record sheet; the air in every case was artificially circulated by means of an electric fan. Experiments of this character were had in mind when the meteorograph was designed by the writer, and a simple arrangement of the clockwork driving the recording cylinder was employed whereby a sufficiently rapid motion of the record sheet (0.2 of an inch per minute) was secured at will by simply tightening a screw. The normal speed of the record cylinder is one revolution in twelve hours or one inch per hour on the record sheet.

It was soon found in the first experiments that the results were rendered indefinite by the circumstance that during the few minutes occupied by the thermograph in assuming the same temperature as that of the air, the latter itself had changed appreciably and in an irregular manner. This was largely remedied by conducting the tests within a closed box approximately circular in form, measuring about 12 inches in depth and nearly 36 inches in diameter. The fan and meteorograph being completely enclosed in this box the same air was driven around and around, so that its change of temperature was a very gradual and progressive one.

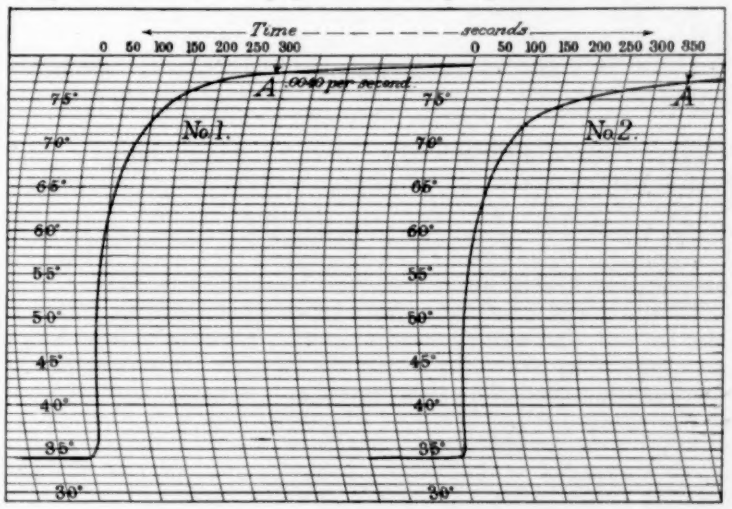

FIG. 4.—Record from kite thermograph.

Fig. 4 is a full scale reproduction of a portion of one of the record sheets, showing two curves for rising temperature. The numbers at the top indicate the elapsed time, in seconds, from an arbitrary starting point; the numbers at the left represent the temperature in degrees, Fahrenheit. At the point *A*, on curve No. 1, careful inspection shows that the thermograph had attained a temperature after which the rate of change was very uniform, as shown by the portion of the record at the right. We assume that this portion of the trace shows the uniform rate at which the air in the box changed its temperature. This conclusion is abundantly sustained by numerous eye readings of a fixed mercurial thermometer, showing practically the same steady change. In the case of the No. 1 record the steady change was at the rate of 0.0040° per second. A large portion of the No. 2 record was omitted in the reproduction of Fig. 4, but the measured rate, after the point *A* was passed, was 0.0039° per second.

It may be remarked here that the record sheets employed by the Weather Bureau on automatic instruments, such as the thermograph in the present case, for example, are printed from photo-engravings on copper or zinc, made by a special process devised by the writer. All the lines are traced automatically by a special dividing engine, and the finished engraving is practically perfect as regards dimensions and

spacings in every detail. It was impossible to bring out all the excellent qualities of the original record in the reproduction shown in Fig. 4, but the originals admit of accurate analysis and measurement.

It was pointed out on page 458, in connection with Fig. 1, that when the medium is steadily changing its temperature there is a certain amount of temperature "lag" in the indications of the thermometer placed therein, depending upon its sluggishness and the change going on in the temperature.

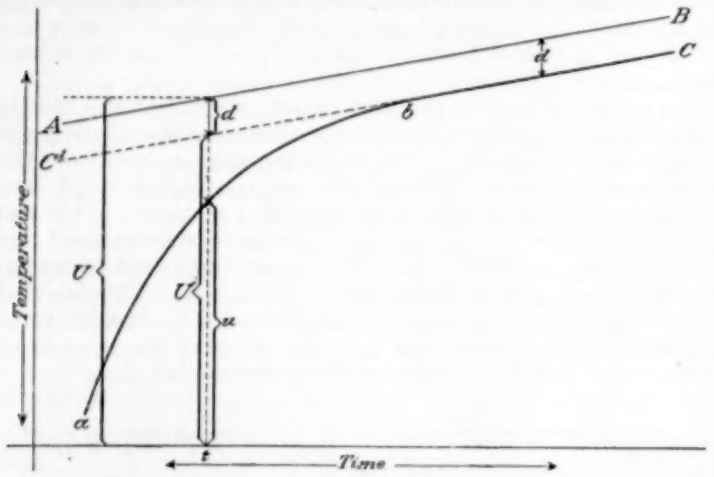

FIG. 5.—Diagram illustrating sluggishness.

These considerations lead to the following method of deducing the coefficient of sensitiveness from such automatic records as shown in Fig. 4. Referring to Fig. 5, let the curved line *a b c* represent the changes of temperature of a thermometer when placed in a medium whose steadily changing temperature is represented by the line *A B*. A portion, *b c*, of the curve *a b c* will, under these circumstances, be parallel to *A B*, and will represent the fact that the thermometer has attained as nearly as it can the changing temperature of the medium, but differs from it by some constant quantity, *d*, as represented. Let the line *b c* be prolonged backward, as shown. Now, at any given instant of time, *t*, let *u* represent the temperature of the thermometer, and *U* that of the air. Also let *U'* be the temperature up to the prolonged portion of *b c*. Then the equation given on page 458 becomes:

$$\text{Rate} = r = k\,(U' + d - u),$$

from which we may write

$$(U' - u)\,k = r - kd.$$

The rate at which the thermometer is changing its temperature at any given instant is easily found from the automatic traces by measuring the inclination of the tangent to the curve at the point in question. This is best done by the aid of a small piece of glass having smooth and straight edges and a fine diagonal line etched on one face. Placing this over the record sheet the line can be adjusted to coincidence with any desired portion of the curve with the utmost exactness. If now a straight edge be adjusted against one edge of the glass, the plate may be shifted along the straight edge and the engraved line made to intersect the rulings of the record sheet in such a manner that the rate may be conveniently and accurately read off. In the present case the number of degrees traversed by the line for one hundred seconds of time was generally made the basis of a measurement, and the rate expressed in degrees per second. Owing to the curved nature of the time rulings on the sheet the rates thus determined are subject to some error, which is quite small at low rates of change, but for large rates the result is entirely vitiated. When the thermometer differs 8° to 10° and less from the air temperature, the corresponding rates can be measured with sufficient exactness. The results thus obtained quite satisfy the object of the present discussion.

The point *A*, Fig. 4, at which the curves merge into the straight line portion, is first carefully located by aid of the line on the glass plate, the rate of change of temperature represented by this line being also determined at the same time. The actual temperature, corresponding to the point *A*, is also noted. This gives us the quantity *U'*, corresponding to the point *A*. The value of *U'* for any preceding instant of time is easily computed from the measured rate for that portion of the record to the right of the point *A*. By way of illustrating further the method of analyzing these records, the following results for curve No. 1, shown in Fig. 4, are given:

TABLE 1.—*Curve No. 1, Fig. 4.*

Time.	U'.	u.	$U'-u$.	Rate.	Equations.	k.
Seconds.	°	°	°		*	
50	77.01	59.00	18.01	.....		.....
75	77.11	68.04	9.07	0.2560	$9.07\,k = 0.2560 - kd$	0.0278
100	77.21	72.30	4.91	0.1900	$4.91\,k = 0.1900 - kd$	0.0379
125	77.31	74.75	2.56	0.0720	$2.56\,k = 0.0720 - kd$	0.0266
150	77.41	76.00	1.41	0.0365	$1.41\,k = 0.0365 - kd$	0.0231
175	77.51	76.60	0.91	0.0260	$0.91\,k = 0.0260 - kd$	0.0242
200	77.61	77.01	0.60	0.0147	$0.60\,k = 0.0147 - kd$	0.0217
285	77.95	77.95	0.00	0.0040	$0.00\,k = 0.0040 - kd$	.....

* Equation indeterminate because of curved rulings, see Table 3.

It will be noticed that each measurement of a rate gives an equation containing *k* and *kd*, also that when the point *A* is reached the term containing *k* vanishes and the equation gives directly a value of the product *kd*. Inasmuch as it seemed probable the value of *k* was not strictly constant for all parts of the curve, it was concluded best to compute individual values of *k* from each equation, using throughout the approximate value of *kd* given at the point *A*. These individual values of *k* are given in the last column of the foregoing table.

Tests of this character were made on four different meteorographs, namely: No. 1, used at the Washington kite station; No. 2, used at Sault Ste. Marie, Mich., and Pierre, S. Dak.; and No. 13, used at Dodge, Kans. The last instrument tested was No. 6, but the arrangement of magnifying levers was changed, so that the rulings on the sheet normally representing degrees corresponded to only 0.31°. This, of course, gave an entirely different character of curvature to the automatic records and rendered the determination of the rates more satisfactory for the smaller differences between the temperatures of the air and the thermometer.

The following tables give the results for the four different meteorographs, the entry $U-u$ being the actual difference between the temperature of the air in each case and that indicated by the thermometer. This is computed from the expression: $U'-u+d$; in which *d* is computed (after *k* has been found) from the equation of the type, kd=rate at point *A* on curves. For example $kd = 0.0040$ for curve No. 1 in table 1 above. A careful inspection of the successive values of *k* led to the conclusion that the experiments failed to show definitely any marked variation of *k* with different magnitudes of the difference $U-u$ between the limits of zero and 10°. The mean values of *k* show a comparatively close agreement.

In order to check the results against possible errors introduced by the curved rulings on the sheets, two curves were carefully redrawn by hand on a larger scale, with strictly rectilinear coordinates. The values of *k* deduced from these curves, together with the corresponding values derived from the original record, are given in the table below.

Except that results could be computed from the curves as redrawn for much greater differences, $U-u$, than on the originals, the foregoing tables show that the results computed directly from the original curves are quite satisfactory, within the limits desired.

TABLE 2.—*Summary of results.*

Meteorograph No. 1.

Rising temperature.			Falling temperature.		
Number of observations.	$U-u$.	k.	Number of observations.	$U-u$.	k.
	°			°	
4.....	7.90	.0280	1	6.48	.0217
4.....	4.37	.0257	6	4.08	.0291
4.....	2.52	.0234	7	2.19	.0244
6.....	1.36	.0230	9	1.27	.0244
3.....	0.77	.0199	10	0.69	.0185
3.....	0.26	.0257	9	0.34	.0264
Means.	.....	0.243	.....	.....	.0241
Mean k from rising and falling temp., .0242					

Meteorograph No. 2.

Rising temperature.			Falling temperature.		
Number of observations.	$U-u$.	k.	Number of observations.	$U-u$.	k.
	°			°	
1.....	8.25	.0352	2	4.74	.0474
2.....	4.90	.0254	2	3.42	.0338
2.....	2.62	.0252	5	1.58	.0272
4.....	1.29	.0211	5	0.78	.0183
3.....	0.67	.0198	4	0.44	.0241
3.....	0.32	.0186	5	0.23	.0296
Means.	.....	.0242	.....	.....	.0301
Mean k from rising and falling temp., .0272					

Meteorograph No. 13.

Rising temperature.			Falling temperature.		
Number of observations.	$U-u$.	k.	Number of observations.	$U-u$.	k.
	°			°	
1.....	9.00	.0358	6	4.43	.0338
3.....	6.85	.0282	3	3.24	.0354
4.....	3.56	.0262	7	1.82	.0318
4.....	1.78	.0262	9	0.94	.0282
5.....	0.87	.0229	11	0.47	.0245
5.....	0.26	.0268	14	0.21	.0254
Means.	.....	.0277	.....	.....	.0298
Mean k from rising and falling temp., .0288					

Meteorograph No. 6.

Rising temperature.			Falling temperature.		
Number of observations.	$U-u$.	k.	Number of observations.	$U-u$.	k.
	°			°	
6.....	3.44	.0307	7	3.44	.0221
10.....	2.18	.0310	10	1.87	.0298
12.....	1.19	.0272	10	1.10	.0240
15.....	0.72	.0217	14	0.63	.0302
19	0.41	.0231	18	0.30	.0293
16.....	0.21	.0295	15	0.10	.0278
Means.	.....	.0272	.....	.....	.0272
Mean k from rising and falling temp., .0272					

General mean, 0.0268° F. per second.

TABLE 3.—*Comparison of results based on curved and rectilinear coordinates.*

CURVE NO. 1.			CURVE NO. 2.		
$U-u$.	Original trace curved ordinates.	Trace redrawn rectilinear coordinates.	$U-u$.	Original trace curved ordinates.	Trace redrawn rectilinear coordinates.
23.44	.....	.0320	28.43	.....	.0310
12.57	.....	.0328	21.04	.....	.0333
6.92	.0260	.0258	14.91	.....	.0283
6.94			6.96	.0286	.0272
3.66	.0260	.0275	6.95		
3.62			3.57	.0238	.0283
1.92	.0206	.0260	3.56		
1.91			1.77	.0232	.0248
.82	.0163	.0280	1.76		
1.07			1.22	.0186	.0157
.81	.....	.0209	1.18		
.34	.0260	.0268	.72	.0131	.0119
.25			.71		
			.29	.0160	.0183
			.28		
			.08	.....	.....

We may therefore fairly conclude that these tests show that k is practically a constant for different values of the difference $U-u$ from 1° to 10° F. Also, that different meteorographs of this same construction are about equally sluggish, even when the scale of temperature is considerably amplified. The sluggishness for rising and for falling temperatures appears to be about the same. Finally, no sensible error is introduced in the method of analysis on account of the curved ordinates of the original records.

The individual determinations show rather large variations from each other and the final mean, it was, however, difficult to maintain a sufficient control over either the temperature conditions or the rate of circulation of the air in the box, and a great part of the variations observed can be attributed to irregular variations of temperature in the box and differences in the circulation of the air through the tube of the meteorograph.

The mean result of all the experiments gives us a coefficient of sensitiveness for the kite thermographs of 0.027° per second. That is to say, under ordinary conditions of ventilation, such as obtain during kite ascensions, the thermographs will change temperature at the rate of 0.027° per second (that is, 1.62° per minute) for each degree of difference between the air temperature and that of the thermograph. This result may be expressed in a different manner by saying that if, for example, the kite in ascending experiences a diminution of air temperature at the rate of 1.62°, F., per minute, then the indicated temperature by the kite thermograph will be just one degree too high. Under ordinary atmospheric conditions this would correspond to an ascension at the rate of over 300 feet per minute, a speed which is not maintained in practical kite flying.

An effort was made to determine the sensitiveness of one of the heavy thermographs, such as used in regular Weather Bureau work. It was impracticable to procure an automatic record from which to deduce the sensitiveness, owing to the very slow speed of the record cylinder. Eye readings were therefore made, but the instrument could not be placed in the closed box used for the meteorographs, and the results obtained show an abnormally high coefficient of sensitiveness for small differences of temperature between the air and the bulb.

Somewhat similar results were obtained from eye readings of mercurial thermometers. In fact the results seem to show the thermograph more sensitive than the mercurial thermometers with small delicate bulbs. It was obviously impossible that this could be the case, and further experiments were deferred until suitable devices could be arranged whereby a more constant air temperature could be maintained and automatic traces secured of the temperature of the bulb under test.

It is seen from the foregoing that the coefficient of sensitiveness of a thermometer is a number which expresses the rate at which the instrument will change temperature in a unit (a second or a minute, for example) of time for a difference of one degree between the temperature of the medium and that of the thermometer. A difference of two degrees will give rise to twice as rapid a change, and so on.

Conversely, if the medium is changing its temperature at a more or less steady rate, the amount of steady "temperature lag" in the indications of a thermometer placed therein will be

$$\text{Lag} = \frac{\text{Steady rate of change of temperature.}}{\text{Coefficient of sensitiveness of thermometer.}}$$

These principles enable us to judge of the degree of accuracy attainable in the use of thermometers for measuring temperatures of the air in the various cases met with in ordinary practice.

SERPENTINE LIGHTNING.

By Dr. J. W. KALES, M. D., Voluntary Observer (dated Franklinville, N. Y., November 13, 1899).

At 8:30 p. m., August 26, a thunderstorm moving from west by south to east by north, passed directly over this station. Heavy clouds obscured the southern sky, while the northern sky remained clear. It was quite dark when the storm reached the zenith. The lightning flashes from west to east were in the upper air, between two and three miles from the earth. Just as the anterior border of the storm cloud reached the zenith a lightning flash appeared about 20° south of zenith

and extended fully 40° in a west-east direction. The color was light yellow, the movement slow, and the appearance that of an immense boa-constrictor. There was the oval head, slightly raised, the constriction forming the neck, the abdominal enlargement, the long tapering tail, and the sinuous gliding snake motion. A few moments later a flash of purple zigzag lightning moving parallel and much more swiftly passed north of the station. To the various forms (zigzag, globe, heat, etc.) of lightning we can add *snake*, i. e., *serpentine* lightning. This observation was clear and distinct.

* * * * * * *

Will not the varying resistance of the atmosphere account for the various forms of lightning observed?

OBSERVATIONS AT RIVAS, NICARAGUA.

The records contributed for many years by Dr. Earl Flint, at Rivas, Nicaragua, include barometric readings. His present station is at 11° 26′ N., 85° 47′ W. The observations at 7:17 a. m., local time, are simultaneous with Greenwich 1 p. m. The altitude of this barometer is now said to be 4 feet above ground; the thermometer 6 feet above ground; the rain gage 7 feet above ground. The ground is 210 feet above sea level. Until the barometer has been compared with a standard it seems hardly necessary to publish the daily readings. The wind force is recorded on the Beaufort scale, 0–12. When cloudiness is less than $\frac{1}{10}$, the letter "F," or "Few," is recorded.

This station is situated on the western shore of Lake Nicaragua, not far from the eastern end of the western division of the Nicaragua Canal. The volcano Ometepe, on an island in Lake Nicaragua, is about 10 miles northeast of the station. Dr. Flint's records occasionally mention the presence of clouds on the summit of this mountain.

Dr. Flint's reports to the Weather Bureau now embrace two distinct features, namely, the simultaneous morning observations and the daily climatological summary, as given in the two accompanying tables for each month.

Simultaneous observations at 1 *p. m. Greenwich* (*or* 7:17 *a. m. local*) *time, September*, 1899.

Date.	Temperature.		Wind.		Upper clouds.			Lower Clouds.		
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.
	°	°								
1	77	73	nw.	0				k.	8	se.
2	78	75	n.	1	cs.	10	sw.			
3	78	75	sw.	1	ck, s.	6		k.	few.	sw.
4	78	75	sw.	1				ak.	8	sw.
5	77.5	75	nw.	0	cs.	2	nw.	k.	6	se.
6	80.5	77	se.	3	cs.	2		fk.	3	se.
7	80	76	ne.	5				ak, k.	5	ne.
8	80	76	ne.	4	cs.	10	se.	k.	few.	ne.
9	79	72	ne.	3	c.	1	se.	k.	few.	ne.
10	78	74	ne.	0	cs.	1	se.	k.	9	ne.
11	79	75	ne.	3	cs, ck.	2	se.			
12	79	72	ne.	3	c.	1	se.	fk.	few.	ne.
13	79.5	75	e.	2	cs.	few.	se.	k.	few.	e.
14	79.5	72	se.	3	cs.	few.	se.	k.	few.	se.
15	80.5	75	e.	2	cs.	6		k.	few.	e.
16	79	72	ese.	3				fk.	8	ese.
17	78	74	se.	2				ak.	9	se.
18	80	76	se.	2				k, kn.	10	se
19	78	77	e.	4				ak, k.	9	se., e.
20	77	74	se.	6				kn.	10	se.
21	79	76	ne.	2	cs.	9	se.	ks, k.	few.	ne.
22	80	76	ne.	1	cs.	6	se.	ak, fk.	3	ne.
23	80	76	ne.	5	cs.	10	ne.	fk.	few.	ne.
24	80	76	ne.	4				fk.	8	ne.
25	80.5	75	ne.	2	cs.	10	se.			
26	80	76	ne.	0	ck.	8	se.	k.	few.	se.
27	81	77	ne.	1	ck.	8	se.	ak.	2	ne.
28	79	75	ne.	3				fk.	10	ne.
29	79.5	76	ne.	1	cs.	9	se.	ks, fk.	1	se.
30	80	74	ne.	1				fk.	5	ne.
Means	79.2									
Departure	+2.3									

Climatological observations for twenty-four hours ending at 7:17 *a. m. local* (*or* 1 *p. m. Greenwich*) *time, September*, 1899.

Date.	Temperature.		Wind.		Average cloudiness.	Total rainfall.	Rainfall at Sapoa.
	Maximum.	Minimum.	Prevailing direction.	Maximum force.			
	°	°				*Inches.*	*Ins.*
1	86.2	74	ese.	5	8	0.00	0.00
2	86.4	75	nw, e, sw.	3	7	0.00	0.00
3	88.5	74	sw, nw.	4	6	0.00	0.00
4	89	76	w, sw.	4	5	0.00	0.00
5	86	75	nw.	4	8	0.93	0.00
6	86	76	variable	3	7	1.93	0.01
7	85	78	se.	5	8	T.	0.19
8	86.3	79	ne.	5	5	0.00	0.04
9	84	78	ne, e.	6	7	0.00	0.45
10	88	78	ne.	6	6	0.06	1.52
11	88.5	78	ne.	3	8	0.05	0.00
12	88	78	ne.	5	6	0.00	0.00
13	87	77.2	ne.	5	3	0.00	0.00
14	88	77.2	e.	5	2	0.00	0.03
15	89	77	e, se.	6	5	0.00	0.28
16	88	79	e, se.	7	7	0.21	0.00
17	85	78	e, se.	7	7	T.	0.25
18	87	78	se.	4	4	0.00	0.31
19	86	80	se.	4	9	0.57	0.81
20	86.2	78	e, ne.	5	4	0.04	0.01
21	80	79	e-se.	6	10	0.51	0.02
22	84	78.4	ne.	4	9	0.00	0.44
23	81	79.2	ne.	6	9	0.08	0.00
24	87	79	ne.	6	5	0.00	0.02
25	89.2	79.4	ne.	4	3	0.00	0.00
26	90	80	ne.	4	6	T.	0.00
27	88.3	79.4	ne.	3	7	0.00	0.00
28	89	80	ne.	3	8	0.00	0.42
29	90	79	ne.	6	9	0.69	0.48
30	86	78.2	ne.	3	8	T.	0.06
Sums						5.07	5.34
Means							
Departure						−4.72	

In this report for September Mr. Flint gives the rainfall at Sapoa, Nicaragua which, like Rivas, is on the southwest shore of Lake Nicaragua, and is about 15 miles southeast of Rivas. He states that the total rainfall during August at Sapoa was 8.94 inches. The details for September are printed above.

Simultaneous observations at 1 *p. m. Greenwich* (*or* 7:17 *a. m. local*) *time October*, 1899.

Date.	Temperature.		Wind.		Upper clouds.			Lower clouds.		
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.
	°	°								
1	77.5	74	n ½ w	0	ck.	8	nw.			
2	77	74	n.	0	ck.	10	nw.	k.	few.	se.
3	77.5	74	n ½ w	0				ak, fk.	9	nw, se.
4	76	73	sw.	0	ck.	2		k.	7	sw.
5	76.5	73	ne.	0				fk, ks.	9	ne.
6	78	75	n.	0	ck.	5	se.	s, fk.	1	se.
7	77	74	n.	0	ck.	9	se.	k.	1	e.
8	77.5	74	n ½ w	1				ak. *	2	ne.
9	79	75	ne.	2				k. *	4	ne.
10	76	73	n.	0	cs.	10	se.			
11	78	75	nw.	1				ak, k.	10	e.
12	77	74	n ½ w	0				k.	9	se.
13	76	75	n.	0				n.	10	ne.
14	76.5	75	n ½ e	0				ks, k.	1,9	se.
15	75	74	w.	0				k, s.	10	e.
16	76	75	sw.	0				kn, ks.	9	sw.
17	76	75	nw.	0				nk, k.	1,9	se, nw.
18	76	73	nw.	0	ck.	3	se.	s.	6	se.
19	79	75	nw.	1	ck., cs.	8	se.	k.	2	ne.
20	77.5	75	ne.	0				fk.	10	ne.
21	74	74	nw.	0	cs., ck.	10	w.			
22	75	73	n ½ w	0				ak.	10	w.
23	75	74	w.	0				ks.	10	w.
24	74.5	72	sw.	0				ak, k.	10	sw.
25	76	75	sw.	0				kn.	10	sw.
26	75	73	sw.	2				ak, n.	1,9	sw.
27	75	74	sw.	3				n.	10	sw.
28	75	75	sw.	0				n.	10	sw.
29	75.5	73	sw.	0				ks, fk.	10	sw.
30	76	75	sw.	0				ak.	7	sw.
31	77	75	ne.	1				kn.	10	ne.
Means	76.4									
Departure	−0.5									

* Cumuli on Ometepe.

Climatological observations for twenty-four hours ending at 7:17 a. m. local (or 1 p. m. Greenwich) time, October, 1899.

Date.	Temperature. Maximum.	Temperature. Minimum.	Wind. Prevailing direction.	Wind. Maximum force.	Average cloudiness.	Total rainfall.	Rainfall at Sapoa.
	°	°				*Inches.*	*Ins.*
1	87	79	ne, e.	3	6	T.	0.00
2	87	76.5	n, e.	2	4	0.00	0.00
3	89	75	n, ne.	3	5	0.00	0.00
4	84	77	n, w.	4	5	0.84	0.00
5	86	75	sw.	3	6	0.00	0.00
6	87.2	75	ne.	2	7	0.65	0.03
7	87.4	75.5	nne.	2	3	0.20	0.00
8	86.5	76	nne.	3	5	0.95	0.43
9	86.4	76	ne.	4	6	0.07	0.10
10	86.3	77	ne.	3	5	0.00	0.05
11	87.5	74.5	ne.	2	6	0.10	0.10
12	84.5	76	wnw.	3	7	0.36	0.01
13	87	75	nw by n.	2	8	1.99	0.23
14	86	75	nnw.	3	8	0.65	1.67
15	85	76	n to se.	2	8	0.07	0.02
16	82	75	w, nw.	3	9	0.50	0.10
17	82.3	75	sw.	3	8	0.22	0.02
18	85	75	w, nw.	4	6	0.01	0.00
19	86	74	ne.	4	7	0.09	0.17
20	82	78	ne.	4	10	0.00	0.86
21	78	75	ne.	2	10	0.07	0.00
22	85	73	ne.	1	6	0.40	0.10
23	83.3	75	sw.	3	5	0.01	0.14
24	83	74.5	sw.	3	9	0.10	0.00
25	80	74	sw.	4	10	0.01	0.39
26	82	76	sw.	6	9	2.84	0.24
27	80	75	sw.	6	8	4.21	0.99
28	80	75	sw.	6	10	1.70	0.71
29	81.2	75	sw.	3	10	0.80	0.09
30	83.1	74.5	sw.	1	7	0.00	0.00
31	84	75.5	ne.	2	3	1.02*	0.00
Sums	84.3	75.4				19.86	6.45
Means							
Departures						+2.90	

* An additional 0.53 inch that fell later is to be carried over to November.

In addition to his record for Rivas, Mr. Earl Flint kindly also sends the rainfall record for Sapoa, which is printed above. The fall at Sapoa was unusually light; that at Rivas, as used by Mr. Flint (20.39 inches, including the 0.53 inch that fell late on the 31st) was 3.43 inches above normal.

METEOROLOGY OF PANAMA.

By Gen. HENRY L. ABBOT (dated Paris, November 11, 1899).

The following additional data are in continuation of my previous contributions to the climatology of Panama and Colon. (See MONTHLY WEATHER REVIEW, May, p. 198, and July, p. 302).

MONTHLY RAINFALL FOR 1899.

The new station, Alhajuela, is on the River Panama, about 18 miles above Gamboa. The height of the instruments is about 50 meters above sea level. The locations of Bohio and Gamboa were given in my previous communication. The following figures for rainfall bring the records up to date:

Stations.	July, 1899.		August, 1899.		September, 1899.	
	Mm.	*Inch.*	*Mm.*	*Inch.*	*Mm.*	*Inch.*
Bohio	451	17.76	330	12.99	226	8.90
Gamboa	240	9.45	278	10.94	342	13.46
Alhajuela	297	11.69	259	10.20	205	8.07

At Alhajuela, during the last 19 days of June, 34 mm., or 1.34 inches, fell.

HOURLY TEMPERATURES IN 1899.

The records made by the self-registering thermometer and barometer at Alhajuela have been read off and the means taken by myself, with the results given in the following table:

1899.	Temperatures. July.		August.		September.		Barometric pressures. July.		August.		September.	
	° *C.*	° *F.*	° *C.*	° *F.*	° *C.*	° *F.*	*Mm.*	*Ins.*	*Mm.*	*Ins.*	*Mm.*	*Ins.*
1 a.m.	25.5	77.9	24.8	76.6	24.7	76.5	760.0	29.92	759.4	29.90	759.9	29.92
2 a.m.	25.3	77.5	24.7	76.5	24.5	76.1	759.7	29.91	759.0	29.88	759.5	29.90
3 a.m.	25.2	77.4	24.5	76.1	24.4	75.9	759.5	29.90	758.8	29.88	759.4	29.90
4 a.m.	25.0	77.0	24.4	75.9	24.2	75.6	759.4	29.90	758.9	29.88	759.6	29.91
5 a.m.	24.9	76.8	24.4	75.9	24.1	75.4	759.6	29.91	759.2	29.89	759.8	29.91
6 a.m.	24.7	76.5	24.3	75.7	24.2	75.6	759.8	29.91	759.5	29.90	760.2	29.93
7 a.m.	24.6	76.3	25.4	77.7	25.7	78.3	760.1	29.93	759.8	29.91	760.6	29.94
8 a.m.	25.1	77.2	26.6	80.0	27.4	81.3	760.3	29.93	760.2	29.93	760.9	29.96
9 a.m.	25.7	78.3	28.4	83.1	29.1	84.4	760.5	29.94	760.2	29.93	760.9	29.96
10 a.m.	26.8	80.2	29.1	84.4	30.1	86.2	760.5	29.94	760.1	29.93	760.6	29.94
11 a.m.	27.5	81.5	29.8	85.6	31.0	87.8	760.3	29.93	759.8	29.91	760.2	29.93
Noon	28.2	82.8	29.9	85.8	31.2	88.2	760.0	29.92	759.4	29.90	759.7	29.91
1 p.m.	28.5	83.3	29.5	85.1	30.5	86.9	759.7	29.91	759.0	29.88	759.2	29.89
2 p.m.	28.3	82.9	29.3	84.7	29.9	85.8	759.2	29.89	758.6	29.87	758.9	29.88
3 p.m.	28.5	83.3	29.2	84.6	29.3	84.7	758.9	29.88	758.3	29.86	758.8	29.88
4 p.m.	28.2	82.8	28.8	83.8	28.8	83.8	758.9	29.88	758.2	29.85	758.8	29.88
5 p.m.	27.7	81.9	28.1	82.6	28.2	82.8	759.0	29.88	758.4	29.86	759.0	29.88
6 p.m.	27.1	80.8	27.3	81.1	27.1	80.8	759.3	29.89	758.7	29.87	759.4	29.90
7 p.m.	26.7	80.1	26.7	80.1	26.4	79.5	759.7	29.91	759.1	29.89	759.8	29.91
8 p.m.	26.4	79.5	26.3	79.3	25.9	78.6	760.2	29.93	759.5	29.90	760.3	29.93
9 p.m.	26.3	79.3	25.6	78 1	25.6	78.1	760.5	29.94	759.9	29.92	760.6	29.94
10 p.m.	26.3	79.3	25.4	77.7	25.3	77.5	760.7	29.95	760.1	29.93	760.6	29.94
11 p.m.	26.1	79.0	25.2	77.4	25.0	77.0	760.6	29.94	759.9	29.92	760.5	29494
Midnight	25.8	78.4	25.0	77.0	24.8	76.7	760.4	29.94	759.7	29.91	760.2	29.93
Means	26.4	79.5	26.8	80.2	27.0	80.6	760.0	29.92	759.3	29.89	759.9	29.92
Maximums	31.0	87.8	34.5	94.1	35.9	96.6	762.2	30.01	761.5	29.98	762.8	30.03
Minimums	22.0	71.6	21.9	71.4	22.0	71.6	756.7	29.79	756.5	29.78	757.0	29.80

The records for these three months are complete, except that during July six days of temperature and three days of pressure records are missing. Nothing is said as to the nature of the self registers, but they are presumably of the Richard pattern and checked by occasional observations of the standard instruments. The observations and records have been made or collected by the officers of the new Panama Canal Company.

TEMPERATURES AT DULUTH, MINN.

By H. W. RICHARDSON, Local Forecast Official (dated October 28, 1899).

Temperature records, Duluth, Minn.

Month.	(1) Mean temperature.	Maximum. Temperature	Maximum. Day.	Maximum. Year.	Minimum. Temperature	Minimum. Day.	Minimum. Year.	(2) Maximum. Times.	(2) Maximum. Above.	(3) Minimum. Times.	(3) Minimum. Below.	(4) 20° falls to 0°.	Consecutive days. (5) Maximum. 80°	Consecutive days. (6) Minimum. 0°
	°	°			°				°		°	°	°	°
January	10.5	51	{28 / 14	1877 / 1894	−41	2	1885	3	50	15	0	2	0	8
February	14.4	58	26	1895	−36	9	1899	3	55	11	0	1	0	6
March	23.6	64	23	1889	−26	19	1875	3	60	5	0	1	0	3
April	38.1	81	29	1891	+ 3	1	1881	4	75	16	32	0	‡	0
May	48.4	88	9	1896	25	1	1888	8	85	2	32	0	1	0
June	57.7	92	{28 / 19	1883 / 1893	33	{8 / 6	1885 / 1897	5	90	2	40	0	2	0
July	66.0	99	1	1883	45	{1 / 2	1888 / 1895	31 / 5	90 / 95	3	50	0	3	0
August	64.8	95	25	1888	40	31	1886	11	90	2	50	0	3	0
September	56.5	94	1	1894	29	29	1899	3	90	1	32	0	1	0
October	44.8	80	7	1886	+ 8	{31 / 25	1878 / 1887	9	75	7	32	0	‡	0
November	28.8	65	{7 / 1	1874 / 1887	−29	29	1875	6	60	2	0	1	0	2
December	17.6	54	12	1891	−34	25	1879	4	50	8	0	1	0	5
Annual	39.3	99	*	1883	−41	†	1885	....	....	....	....	6	12	24

*July 1. † January 2.

‡ The maximum temperature of 80° or more occurred twice in 26 years in April and June.

(1) The first column relates to the 29 years, November, 1870, to October, 1899, inclusive, the rest of the table relates to the 26 years, November, 1873 to October, 1899.

(2) The total number of times the temperature equaled or exceeded 50° or other specified degrees.

(3) The average number of times the temperature equaled or fell below 0° or other specified degrees.

(4) Average number of times that the temperatures fell 20° or more in twenty-four hours, and reached zero or lower.

(5) The average of the greatest number of consecutive days whose maximum temperature was 80° or above.

(6) The average of the greatest number of consecutive days whose minimum temperature was zero or below.

The following temperature data for Duluth were prepared for publication in a local paper and, at the request of the Editor of the REVIEW, have been expanded slightly, as shown in the preceding table. A study of the figures here given will show that the climate at the head of Lake Superior is invig-

orating and healthful. Our summers and autumns are usually very pleasant, the summers especially so, and with an appreciable absence of those two weeks of continuous and debilitating sieges of warmth that one encounters a little further southwest and south. To be sure our winters are long, but the cold is steady. The early portion of the spring is generally rather unpleasant, but I have experienced fully as bad, or worse, elsewhere.

Average temperature of spring months, 36.7°; summer, 62.8°; autumn, 43.4; winter, 14.2°. Average of the warmest spring, 44.4; warmest summer, 67.2°; warmest autumn, 47.3°. Average of the coldest spring, 30.9; coolest summer, 59.1°; coldest autumn, 39.1°; coldest winter, 6.2°. Spring months: March, April, and May; Summer: June, July, and August; Autumn: September, October, and November; Winter: December of previous year, January and February following.

Greatest number of days in any month, for twenty-six years, with minimum temperatures of zero or below: January, 24; February, 24; March, 12; November, 8; December, 19. Least number of days in any month with minimum temperatures of zero or below: January, 3; February, 0; March, 0; November, 0; December, 0.

Greatest number of days in any summer month with maximum temperatures of 90° or above: June, 1; July, 5; August, 2.

Number of years maximum temperature of 90° or above did not occur: June, 22; July, 12; August, 18; September, 23.

The minimum temperature usually falls to 32° or below, 168 times each year, and to zero and below 41 times.

Number of actual falls in temperature of 20° or more to 32° and below, twenty-six years' record: April, 6 times; May, 3; September, 0; October, 3.

NOTES BY THE EDITOR.

THE RAIN GAGE AND THE WIND.

On page 454 we give an interesting letter from G. J. Symons, Esq., the well known and most eminent authority on British rainfall, and in order that the influence of the wind on the catch of the gage may be more fully appreciated, we reprint the greater part of a study of the subject made by the Editor in 1887. This paper was read in full before the Philosophical Society of Washington, November 24, 1888. Some portions were published in the American Meteorological Journal in 1889–90, Vol. VI, pp. 241–248 and in Symons's Meteorological Magazine, Vol. XXIV, pp. 130–135, and in the Proceedings of the International Meteorological Congress at Paris, September, 1889, Vol. II, pp. 241–248. It was, however, not fully published until 1893, when it appeared as an appendix to Bulletin No. 7 of the Forestry Division of the Department of Agriculture. As the edition of that bulletin is now exhausted, and as the subject of this study is of the highest importance to others besides foresters, the present reprint will respond to the needs of all.

Mr. Symons writes that he has just started a Nipher shielded gage on the Cheviots on the flat top of a conical hill about 2,000 feet high, by the side of an ordinary gage which has been there four or five years; the records will probably begin to be published in about two years.

With regard to the accuracy of rainfall measurements viewed simply as comparable data, two matters have been studied experimentally, namely, the size and style of the gage and the altitude above ground. With regard to size it is satisfactorily shown that no error of more than 1 per cent systematically attaches to gages of the ordinary forms and of diameters anywhere between 4 and 44 inches. With regard to the altitude it must be conceded that for a hundred years it has been known in a general way that observations by gages at various heights above the ground are not comparable with each other. The remarkable influence of altitude was first brought to the attention of the learned world by Heberden, who, in a memoir in the transactions of the Royal Society of London, in 1769, stated that a gage on Westminster Abbey over 150 feet above the ground caught less than half as much as a gage at the ground. Since his day numerous others have instituted similar observations in their respective localities. Usually they have been satisfied with observing only one or two elevated gages, but of late years, in order to fully elucidate the subject, more elaborate measurements have been made; thus Phillips and Gray, at York, England, have observed at eight different altitudes including the gage on the tower of York Minster.

Bache, at Philadelphia, observed four gages on top of a square tower, and four others on poles above them; Col. Ward, at Calne House, Wiltshire, observed ten pairs of gages at elevations of 20 feet or less, each pair consisting of an 8-inch and a 5-inch gage; Bates, at Castleton Moor, similarly observed ten pairs of gages; Chrimes, at Rotherham Reservoir, six gages, at elevations of 25 feet or less; (——?) at Hawsker, four 3-inch gages, at altitudes of 10 feet or less; Wild, at St. Petersburg, six 10-inch gages, at altitudes of 5 meters or less, and one at an altitude of 25 meters. A very laborious series of six or eight gages at altitudes of 40 feet or less has, to my knowledge, been carried on for some years by Fitzgerald, at Chestnuthill, near Boston, but the results are not yet published.

It will be seen, therefore, that abundant observational data are at hand for the elucidation of the peculiarities of the rain gage, and the results that can be deduced from such data command our immediate attention. Whatever mystery has hitherto attached to the undoubted fact that elevated gages catch less rain is now fully explained away. This phenomenon is of the nature of an error in the rain gage depending upon the force of the wind that strikes it, and as will be seen, now that the knowledge of the source of error has been established, the method of correcting or preventing it becomes simple.

It will be remembered that Benjamin Franklin, upon reading Heberden's memoir, at once, in 1771, in a letter to Percival explained his results by the hypothesis that falling cold rain drops condense the moisture they meet with in the warmer lower strata, and that Phillips, in 1834, independently revived this hypothesis as explaining the increase of rainfall. A much truer explanation had been suggested by Meikle, in the Annals of Philosophy for 1819, and by Boace (Annals of Philosophy, 1822), to the effect that the deficiency is due to the velocity of the wind and to the fact that the gage stands as an obstacle to the wind; also Howard showed that the strength of the wind affected the higher gage. But these minor notices seem to have produced but little effect among the meteorologists, and it remains for W. B. Jevons, Phil. Mag., 1861, Vol. XXII, to demonstrate that the Franklin-Phillips hypothesis was highly unsatisfactory, and in fact impossible, and that the true reason for diminution of apparent rainfall with the height of gage is the influence of eddies of wind around the building and the mouth of the gage. This explanation had, however, been also quite clearly pointed out by Prof. Bache, who had shown that eddies around the top for the tower affected the distribution of the rainfall on the tower. Alexander Dallas Bache and Joseph Henry were intimately associated in their scientific work as early as 1835 (and especially after Henry came to Washington, in 1847), and the latter had adopted that which is now called Jevon's explanation, although as we have seen it was first given by Meikle, 1819, and subsequently independently arrived at by many others. This theory was definitely adopted and disseminated by Henry at least as early as 1853 in connection with his instructions to Smithsonian observers.

The essence of this explanation may be stated thus: In the case of ordinary rainfalls we invariably have the air full of large and small drops, including the finer particles that constitute a drizzling mist and the fragments of drops that are broken up by spattering. All these are descending with various velocities which, according to Stokes, depend on their size and density and the viscous resistance of the air; the particles of hail descend even faster than drops of water and the flakes of snow descend slower than ordinary drops. Now when the wind strikes an obstacle the deflected currents on all sides of the obstacle move past the latter more rapidly; therefore, the open mouth of the rain gage has above it an invisible layer of air whose horizontal motion is more rapid than that of the wind a little distance higher up. Of the falling raindrops the larger ones may descend with a rapidity sufficient to penetrate this swiftly moving layer, but the slower falling drops will be carried over to the leeward of the gage, and failing to enter it will miss being counted as rainfall, although they go on to the ground near by. Evidently the stronger the wind the larger will be the proportion of small drops that are carried past the gage; or again, the larger the proportion of small drops and light flakes of snow that constitute a given shower, the more a gage will lose for a given velocity of the wind. In brief, the loss will depend both upon the velocity of the wind and

the velocity of the descent of the precipitation; therefore, a gage will in general catch less, in winter than in summer—less in a climate where light, fine rains occur than where the rains are composed of larger, heavier drops; less in a country or in a season of strong winds than of feeble winds; less when exposed to the full force of the wind by being elevated on a post than when exposed to the feebler winds near the ground.

The action of the wind in blowing the precipitation over to the leeward of the gage depends on velocity rather than on the square of the velocity of the wind and of the raindrop, and it is aggravated by the formation of whirls or eddies within the gage itself by reason of which light and dry snowflakes are even whirled out of the gage after being once caught in it. Similar remarks apply to the rainfall on the top of a large square building with a flat or depressed roof; not only does the top as a whole receive less than an equal area at the ground, but the distribution of rainfall on the roof is such that the least rain falls on on the windward portion and the most on the portion to leeward, while somewhere on the roof will be found a region whose average rainfall coincides with that on the ground. But the location of this region will vary with the direction and strength of the wind and the quality of the precipitation, so that we have but little assurance that any single rain gage on the roof will represent the rainfall on the ground.

An interesting illustration of this action of the wind has been noted by me in the case of several gages established in a cluster in the sandy region at Kittyhawk, N. C. The gages sat on the ground; their mouths were 2 or 3 feet above the surface, and being cylindrical they offered considerable resistance to the wind. The windward gages caught less rain than the leeward, but they also caught more sand, showing that the strong winds which carried the light raindrops on beyond also stirred up the light surface sand and were just able to drop the sand into the windward gages while carrying the rain on to the leeward gage. In accordance with the preceding explanation all observations everywhere show that the higher gages have the larger deficit in rain catch and still larger deficits in the snow catch, and that both deficits increase with the wind.

Mordecai states (Journal Franklin Institute, 1838, Vol. XXII, p. 37) that he arranged his observations at Frankfort Arsenal to show the rain catch at the ground and on the tower 52 feet high according to the force of the wind as estimated by him on the scale 0 to 10 as used by him, and found the deficit of the tower gage to be 0 per cent for calms and light winds, but increasing steadily up to 36 per cent for a wind of force 8.

Börnstein (Met. Zeit. Oct. 1884) arranged the catch in protected and unprotected gages according to the velocity of the wind, and for seven months of observation obtained the following deficits in millimeters, to which I add the same converted into percentages on the assumption that the protected gage is practically equivalent to the pit gage. This assumption, although it is not quite correct, will not greatly change our results:

TABLE 1.

Wind force 0 to 12	Number of days.	Protected gage catch	Unprotected gage.		
			Catch.	Deficit.	Deficit.
		Mm.	*Mm.*	*Mm.*	*Per cent.*
0	5	3.30	3.06	0.24	7
1	37	88.34	81.44	6.90	8
2	26	70.40	63.80	6.60	9
3	15	36.62	29.89	6.73	18
4	15	43.45	39.57	3.88	8
5	1	2.50	1.50	1	40
6	1	1.76	1.38	0.38	22

The distinction between the effect of the winds in heavy rains and fine rains is very clearly brought out by Börnstein's classification of the catch on twenty-six days of fine rain and forty-three days of heavier rains; the percentages are as shown in the following table:

TABLE 2.

Wind force.	43 heavy rains.		26 fine rains.	
	No. of days.	Deficit.	No. of days.	Deficit.
		Per cent.		*Per cent.*
0	.....	.....	4	23
1	17	6	8	25
2	13	13	6	18
3	7	14	6	46
4	6	17	2	52

Although all these preceding data, both by Mordecai and Börnstein, are limited in quantity, yet they conspire to show uniformly the same effect of the wind that is shown in an exaggerated scale when the ordinary gage is used to catch snowfall. Similar results based on a somewhat larger series of observations are published by Wild (Repertorium für Met., Vol. IX), as shown in the following Table 3, which gives the percentage of catch during the winter's snow and summer's rain separately for several altitudes and wind velocities:

TABLE 3.

Altitude.	Low wind velocities (2 to 5 meters per second).		High velocities (6 to 9 meters per second).	
	Rainfall (Apr.-Oct.).	Snowfall (Nov.-Dec.).	Rainfall (Apr.-Oct.).	Snowfall (Jan.-Mar.).
Meters.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
0	100	100	100	100
1	95	89	94	80
2	92	86	84	82
25	81	26	56	16

These tables conclusively show the large influence of the wind on the catch of the rain, to say nothing of its influence on the catch of the snow. It is, therefore, evident that the annual rain precipitation, as shown by gages at various heights, although always diminishing with the altitude, will diminish in different ratios according to the peculiarities of the precipitation and the wind in that locality.

Without attempting to go into special refinements it will be sufficient for the present to study the annual catch as recorded at numerous stations. I have, therefore, in the following Table 4 arranged the results quoted by Wild (Repertorium Vol. IX, 1885,) and some others that have been published elsewhere. This table begins with the results of observations made at low altitudes, and of these I have taken the average of all observations made for four years at Calne, three years at Castleton, eight years at Rotherham, and ten years at St. Petersburg with gages of from 5 to 10 inches diameter. I have omitted the observations for two years at Hawsker with 3-inch gages, because of the shortness of the series and the smallness of the gage, which latter point has slightly exaggerated the percentage of loss. The combined result, therefore, for the 4 longer series is to show that for gages of such size and construction as are generally used in the weather bureaus of the present day, and for the average wind and snow or rain that occurs at these stations (which are in fact fair representatives of the northern portion of the temperate zone) the catch of rainfall diminishes with height of gage, as shown by the percentage in the last column, and in which, of course, the catch of the normal pit gage is adopted as the standard.

TABLE 4.

Location.		No. of years.	Altitude.	Relative catch.
			Meters.	*Per cent.*
			0	100
Calne	5 and 8-inch gages.	4	1	90
Castleton	5 and 8-inch gages.	3	2	88
Rotherham	5-inch gages	8	3	86
St. Petersburg	10-inch gages	10	4	85
			5	85
			6	84
London: Westminster Abbey	.....	1	9	77
Emden	.....	2	11	72
St. Petersburg: Central Observatory	.....	1	13	68
York: Museum	.....	3	13	80
Calcutta: Alipore Observatory	.....	7	15	87
Woodside: Walton on Thames	.....	1	15	73
Philadelphia: Frankfort Arsenal	.....	3	16	95
Sheerness: Waterworks	.....	3	21	52
Whitehaven: St. James's Church	.....	10	24	66
St. Petersburg: Central Observatory	.....	10	25	59
Paris: Astronomical Observatory	.....	40	27	81
Dublin: Monkstown	.....	6	27	64
Oxford: Radcliffe Observatory	.....	8	34	59
Copenhagen: Observatory	.....	4	36	67
London: Westminster Abbey	.....	1	46	52
Chester: Leadworks	.....	2	49	61
Wolverhampton: Waterworks	.....	3	55	69
York: Minster	.....	3	65	60
Boston: St. Botolph Church	.....	2	79	47

For gages higher than 6 meters this table gives the results of the individual localities. If we consider the individual figures in the latter part of this table it would seem that the diminution of rainfall with elevation of gage is decided, but irregular; but it is proper to collect the data into a few mean values as shown in the following table, in which the last three groups may be considered to represent the average conditions of the precipitation in the temperate zone quite as fairly as do those of the lower altitudes:

If we may assume that on the average of the years and of the localities thus grouped together there is a fairly uniform average quality of precipitation, we should expect the deficiency at each altitude to have

some definite relation to the velocity of the wind, and it emphasizes our conviction that the wind is the principal factor in bringing about this deficit when we find that these normal percentages are fairly represented by the simple formula: Deficit = 6 per cent of the square root of the altitude expressed in meters, or 3.9 times the square root of the altitude expressed in feet.. The adoption of the simple square root of the altitude is of course suggested by the well-known studies of Stephenson and Archibald, from which I infer that for these low altitudes the square root is a satisfactory approximation to the rate of increase of wind with altitude, while for much higher altitudes the one-fourth or other power might be preferable. The constant factor, 6 per cent, that enters this formula, will of course not be understood as applicable to other gages or velocities, or qualities of precipitation than those included in the above table, but the close agreement of the computed percentages of deficiency shows that we appear to be on the right track, and that some method must be devised by which to free rainfall measures from the influence of the wind at the mouth of the gage. We see, in fact, that the simple wind gage which we had trusted so long is liable to systematic error, whose magnitude is really enormous as compared with the small errors that we ordinarily investigate in connection with thermometers, barometers, and anemometers.

TABLE 5.

Group.	No. of stations.	Altitude.	Observed deficit.	Square root of altitude.	Computed deficit.	Observed, minus computed deficit.
		Meters.	*Per cent.*			
1	4	0	0	0.00	0	0
2	4	1	10	1.00	6	+ 4
3	4	2	12	1.41	8	+ 4
4	4	3	14	1.73	10	+ 4
5	4	4	15	2.00	12	+ 3
6	4	5	15	2.24	14	+ 1
7	4	6	16	2.45	15	+ 1
8	7	13	21	3.61	22	− 1
9	7	28	36	5.20	32	+ 4
10	5	59	42	7.68	46	− 4

ELIMINATION OF ERRORS DUE TO THE WIND.

Two methods are open to us by which to eliminate this error of the rain gage. One is instrumental, the other observational.

Instrumental methods—As before said, Professors Bache and Henry seem, from their own observations, to have clearly apprehended the nature of the error with which the gage is affected, and the latter was quick to suggest the remedy, namely, to so construct a gage that it shall closely imitate the conditions of the normal exposure, or that of a gage whose mouth is on a level with the ground, and which is, therefore, not covered over by the disturbing swift currents and eddies. The records of the Smithsonian show that Henry caused numerous experiments on this subject to be conducted after he and Espy, in 1848, inaugurated the Smithsonian system of meteorological observers. In the second volume of Henry's collected writings, the reader can easily consult his discussion of the erroneous explanations and his own correct explanation of the phenomenon, and at page 262 will be found Henry's suggestion of "the shielded gage." This shielded gage was an ordinary small cylindrical gage; a few inches below the mouth of this gage a horizontal circular plate of tin 4 or 5 inches wide was soldered to it like the rim of an inverted hat; by this means he hoped to ward off the disturbing eddies which would necessarily be formed almost wholly beneath the flat rim and therefore harmless.

Although Henry's shielded gage was described at least as early as 1853, yet I have not found as yet any records of observations made with it, though such probably exist, as Henry's suggestion was widely distributed among the Smithsonian observers.

In 1878 Professor Nipher, of St. Louis, published the first results of his observations with his own shielded gage, as independently invented by him. He surrounds the upper portion of the gage by an umbelliform screen made of wire gauze; the falling rain strikes on this and breaks up, and falls down to the ground without spattering into the mouth of the gage at the center, while the gauze sufficiently breaks up the wind currents to maintain a normal condition of the air at the mouth of the gage. Nipher's own experiments with this gage showed that its catch at a height of 118 feet above the ground was nearly the same as that of the ground gage itself.

The invention of the shielded gage gives us the required instrumental solution of our problem. Of late years Börnstein, in Berlin, and Wild, in St. Petersburg, have experimented very largely with Nipher's shielded gage and have reported in its favor. Hellmann, during 1887, also observed with a Nipher gage, and finds the effect of the shielding to be very favorable, but not so much so as to make it quite equal to the ground gage.

The good accomplished by the shields adopted by Henry or by Nipher can also be largely attained by a simple system of protection from wind. By "a protected gage" I mean an ordinary gage whose mouth is a few feet above the ground and which is surrounded, at a distance of a few feet, by a fence or screen separate from the gage and whose top is a little above the mouth of the gage. The protecting fence is, therefore, so arranged that it diminishes the wind at the mouth of the gage without itself introducing new and violent injurious eddies. Börnstein, Wild, and Hellmann have experimented with such protected gages, the protecting fence being so constructed that the angular altitude of the top of the fence as seen from the mouth of the gage is between 20° and 30°. The catch of the gage thus protected always exceeds that of the free gage, so that the correction to reduce it to the ground gage is comparatively quite small, the deficit being reduced from 25 per cent down to 3 or 4.

Hellmann has also made the following interesting experiment: The roof of the Academy of Architecture in Berlin, where the Royal Prussian Meteorological Institute is temporarily domiciled, covers about 50 meters square, and is not merely flat, but depressed considerably below the rampart walls of the building. It, therefore, constitutes a grand protection to any gage placed near the center of the roof, and accordingly Hellmann finds that in this location gages catch more than anywhere else on the roof or the ramparts, and but little less than a gage on the ground. His conclusion is that the Nipher, or similar protection, can nearly, but still only partly, annul the injurious influences of strong winds on the catch of the gage.

The reduction or correction of rainfall for altitude, as it has hitherto been called, is, therefore, really a correction or reduction of the readings of the rain gage for an instrumental error due to the wind.

Observational methods.—As an observational method of obtaining the true rainfall from the gage reading, when it is impracticable to establish a normal pit gage in a good location, or when it is desired to determine approximately the correction to be applied to past records obtained from a gage that still remains in the former place, the following arrangement offers a fair approximation:

If the present gage has been standing in an open field at a few feet elevation, place two or more *similar gages* near it, and similarly located as far as obstacles are concerned, except only that one of these is to be decidedly lower than the old one and the other decidedly higher. From a comparison of the simultaneous records of any two gages and their altitudes, we should for each separate rainfall, rather than for the monthly and annual sums, deduce the normal rainfall by the solution of two or more equations of the form:

Observed catch of gage $= (1 - x\sqrt{\text{altitude}}) \times$ (desired catch of normal pit gage).

Where x is the unknown special coefficient of deficiency due to wind at that altitude. Having two gage catches, c_1 and c_2 for the two altitudes H_1 and H_2, we may represent the true rainfall (R) by the formulæ:

$$c_1 = (1 - x\sqrt{H_1})\ R$$
$$c_2 = (1 - x\sqrt{H_2})\ R$$

whence

$$R = \frac{c_1\sqrt{H_2} - c_2\sqrt{H_1}}{\sqrt{H_2} - \sqrt{H_1}} = c_1 + \frac{1}{\sqrt{\frac{H_2}{H_1}} - 1}(c_1 - c_2) = c_1 + n(c_1 - c_2).$$

If c_1 and H_1 relate to the lower gage we shall generally have $c_1 > c_2$ and $H_1 < H_2$ and the coefficient n will be a positive fraction, whose value is given in the following table for such combinations of units as may easily occur in practice.

TABLE 6.

Values of n.

Altitude of upper gage.	Altitudes of lower gage.				
	1	2	3	4	5
2	2.414				
3	1.366	4.450			
4	1.000	2.414	6.469		
5	0.828	1.721	3.438	8.474	
6	0.689	1.366	2.414	4.450	10.485

If the present gage be located upon the top of a building, perhaps the best that can be done to study the accuracy of its records is to locate other similar gages so as to get the average rainfall over the whole roof at the same uniform altitude; the next best would be to establish a standard protected or shielded gage as high as practicable above the roof.

If a new observing station is to be started then a single shielded or protected gage is better than a single unprotected one; but two more shielded gages at different altitudes afford the means of calculating the correction for wind which will, of course, be quite small for this style of gage.

VARIATIONS IN GEOGRAPHICAL DISTRIBUTION OF RAINFALL.

By the combination of records from widely separated rainfall stations we ordinarily seek to determine the uniformity or irregularity of rainfall as to its geographical distribution. The study of horizontal

distribution of rain should be first made by means of simultaneous observations at many stations within a small region. The most instructive work of this kind that I know of is that just now being carried on by Hellmann in the "experimental rainfall field" of the Royal Prussian Meteorological Institution. This institution was in 1884 officially transferred from the bureau of statistics, where it had been organized by Mahlmann and Dove, over to the bureau of religion, education, and medicine, where it is now intimately connected with all the scientific and educational work in Berlin and is under the directorship of Prof. W. von Bezold. The experimental rain field really consists of the City of Berlin and the country around, especially to the westward, embracing a region of about 15 kilometers square, within which are located Berlin, Spandau, and Potsdam The forests on the westward, the intermediate gardens and fields, the valley of the River Spree, and the City of Berlin, offer a great variety of surfaces but without any mountains or hills. The average height of the ground above sea level is scarcely 50 meters, the average distance of the gages from each other, namely, the mean of all possible combinations is about 4.5 kilometers, the maximum distance being 11 and the minimum 0.5.

Within this area Hellmann has twenty-one stations, some of which represent several gages. His work began in 1884, and he adopted as the standard height of the mouth of the gage 1.07 meters above the ground. I have selected for study the eleven stations for which complete records for 1886-'87 are given in Hellmann's Reports. The accompanying Table 7 shows the rainfall for each station for each year and the departures of each station from the annual mean of the eleven. From these departures we get the probable error of any one annual rainfall as plus or minus 6 per cent of its own value. That is to say, assuming that the same quantity of rain and snow fell uniformly over the whole of this small region and that the gages, if unaffected by any error, should therefore agree among themselves perfectly, then their failure to do so is such that it is an even chance that any given rainfall is discordant from the average by plus or minus 6 per cent. At first Hellmann suggested that the records of stations 1, 2, 3, and 4, which were in the open land east of the forests, showed that less precipitation fell there than over the forests, affording an argument for the idea that the forest attracted an extra amount of rain; but of the other stations there were also some that were protected by the forests, and next year all of these reported large rainfalls. Now all of these gages were at a standard height in open regions such that only the variations in wind proper or in the currents induced by neighboring obstacles could conceivably affect the catch of the gage; moreover the differences between the stations were greatest in the winter and least in the summer months. All his study of the configuration of the ground around the stations tends to show that the differences in the catches of the gages were due to the irregularities of horizontal distribution of the strength of the wind as influenced by the surroundings. In other words, instead of studying geographical or horizontal distribution of the total annual rainfall it is safe to assume that this had been uniform for each year over this small area, and that we are studying simply the horizontal distribution of a deficiency in catch, or a rain-gage error due to very local winds at the mouths of the gages.

TABLE 7.

Station, Hellmann's number.	Observed precipitation.		Departures.			
	1886.	1887.	1886.	1887.	1886.	1887.
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Per ct.*	*Per ct.*
1	394	514	30	4	7	1
2	363	507	61	11	14	2
3	387	524	37	6	9	2
4	338	505	36	13	9	2
6	435	492	11	26	3	1
7	438	536	14	18	3	1
8	462	549	38	31	9	2
9	462	509	38	9	9	2
10	473	536	49	18	12	2
12	444	516	20	2	5	1
14	422	516	2	2	0	0
Mean	424	518	336	140	.....	.....

This conclusion is confirmed by examining the records in the summer months separately from those in the winter. Local showers are frequent during the summer and the irregularities in horizontal distribution are presumptively greatest at that time. During the winter the extended layers of clouds give us no *a priori* reason to expect large irregularities in the geographical distribution of snowfall and rain. Hellmann's records show that the geographical irregularities in the catch of his gages is really least in summer and greatest in winter, thus confirming our convictions that on the average of the year the precipitation is uniformly distributed and the variations in catch depend on the irregular distribution of the wind at the mouths of the gages during the fall of rain and snow.

The eleven gages here selected from Hellmann's data were unprotected and uniformly 1.07 meters above ground, and it is evident that they would not have necessarily shown a similar discrepancy of 6 per cent among themselves had they been placed at some other altitude. As the absolute deficits of each gage increase like the wind with the square root of the altitude, so also should the apparent irregularities in geographical distribution. But this rule should not be so far stretched as to assume that gages at the ground surface would therefore show no irregularities in the horizontal distribution of rain, the fact being that there is even for them an outstanding uncertainty of 2 per cent, which is the total combined effect of all the irregularities of measurement and the drifting of snow or rain.

In general, then, we conclude that in the case of a number of gages placed within a few miles of each other, and of which we know nothing as to the height and exposure, except that in general the observers have placed them in fairly open situations, there is no reason to give a preference to the reports of one gage rather than that of another, since if the observers are equally reliable the irregularities of catch are likely to far exceed the errors of careful observers. Again, the probable error of 6 per cent, due to unobserved and uncontrollable irregularities in the action of the wind on these ordinary cylindrical gages located 1.07 meters above the ground, indicates the utmost limit to which any attempt at refinement in drawing annual isohyetal lines should be carried at present, at least in climates such as that of Berlin, and until the data are corrected for wind effects. Finally, any attempt to deduce from such gages the relative rainfall over the forest, the cleared land, the hill and the valley, can only be successful in so far as we make due allowance for the influence of the wind and the character of the precipitation.

CHRONOLOGICAL VARIATIONS OF RAINFALL.

What has just been said with regard to geographical distribution holds good equally with regard to the chronological variations in rainfall. Undoubtedly there are years of large and of small precipitation, but if we analyze these years we shall see that they differ, not only in the quantity, but at the same time in the quality of the precipitation and in the force of the winds. Until we are able to correct the measured rain or snow for the wind effect we must include this large source of uncertainty in the catalogue of errors to which our measurements are subject; thus, in some years, there may be a heavy snowfall of very light snow flakes falling during strong wind, and in spite of all our efforts to estimate we get too small a record. Again, if we confine ourselves to the summer rains only, namely, those that directly affect the growth of plants, we shall find that in almost every long-continued series of observations at any locality trees, houses, and other obstacles have gradually grown up in the neighborhood so that the average wind force at the gage has undergone a steady progressive diminution and the gage, therefore, catches a larger percentage at the close of the series than at the beginning, unless the obstacles were always so near as to shelter the gages. I have computed the departure of each annual total precipitation (rain and snow) from the mean of forty-six years at Fort Leavenworth, Kans. (using post-surgeon's record only); of twenty-two years at Spiceland, Ind. (observations by H. R. Dawson), and forty-two years at Washington, D. C. (observations at the Naval Observatory). From the mean of these departures it is easy to compute the so-called probable error or departure for any one year, or the index of variability of annual precipitation. The results are given in the accompanying Table 8, and are interpreted in the following paragraph:

TABLE 8.

Stations.	Number of years.	Average total annual precipitation.	Probable error of annual precipitation.		Probable error of mean of 49 years.	
		Inches.	*Inches.*	*Per cent.*	*Inches.*	*Per cent.*
Leavenworth	46	32.48	6.02	18	0.86	2.6
Spiceland	22	39.40	5.47	14	0.78	2.0
Washington	42	39.48	5.20	13	0.74	1.9

The mean annual catch at the Fort Leavenworth gage is 32.48 inches, as given by forty-six years of observations, which, however, differ among themselves from year to year so much that it is an even chance that the catch of any one year will differ from this mean by more or less than 18 per cent of its value, or by 6.02 inches; this 18 per cent is in part due to actual irregularities in rainfall, and in part to the variable effect of the wind and the irregular proportions of snow and rain; the actual rainfall is larger than this catch by an unknown amount depending on the character of the precipitation and the strength of the wind at mouth of the gage.

It is, therefore, evident that any conclusion as to a change of climate during these years involving quantities less than the probable errors of the mean rainfall must be entirely illusory.

RECOMMENDATIONS.

Our study of the rain gage and its errors would have a melancholy conclusion, did it not afford us some suggestion as to the proper

methods of determining and allowing for these errors. In view of our present knowledge we now see that in establishing new stations better methods of exposure should be adopted, and such as are in fact very different from those that have hitherto been considered allowable. We must closely imitate the conditions prevailing at the average surface of the ground, that is to say, in the order of preference the exposure would be: (1) the pit gage; (2) the protected or the shielded gage near the ground; (3) several protected or shielded gages distributed over a flat roof; (4) the shielded gage on posts considerably elevated above slanting roofs. Moreover, in no case should a single gage be relied upon, but in all cases at least two similar gages at very different heights should be observed. From the records of these two gages we can compute the catch of the normal pit gage by the formula previously given.

As this formula is also applicable to the ordinary, and in fact to any form of gage, we furthermore see that an approximate correction, needed to reduce valuable past records to the normal gage, may now be determined, if these old gages are still being recorded, by at once establishing near them two or more similar gages at considerably different heights; from the records of all these gages for the next few years we may determine, at least approximately, a correction applicable to the past years of historical records. Finally, we are warned against attempting to draw from past records conclusions that are finer than the data will justify.

METEOROLOGY BY THE LABORATORY METHOD.

The November number of Popular Astronomy contains the following admirable article on the teaching of astronomy, which applies equally well to meteorology and is to be commended to all teachers and students.

If by the laboratory method is meant such observation and investigation of selected phenomena pertaining to any subject as shall yield to the student an abundance of essential facts—if it mean that from the many such related facts reasonable explanations of these phenomena may be expected from the student who thinks simply and logically—if it be a manner of so presenting a subject through its phenomena to the mind of a student that he may reach out toward conclusions of a general nature, to the principles and laws which pertain to that subject, as a direct sequence of his own observations and thought processes—if these be the aims of laboratory methods of teaching, then astronomy [and meteorology] may be thus taught, and demands such manner of presentation to the students of our secondary schools.

It is far from our purpose to pose as an instructor in pedagogy, or to enter upon any psychological discussion whatsoever. Yet it were pardonable, surely, to restate as a cardinal principle of educational work that mental growth results only from mind activity rightly directed. As the highest and best of the physical being demands that every muscle have its exercise and development, so the mind in its every capacity is to be exercised.

One stage in the development of the science of education was content to have the student memorize the words of the text regardless of any full comprehension of the thought expressed therein. It was a great step in advance when mastery of the thought of the author was made of prime importance, and the expression of that thought in the words of the student himself was encouraged or required. There remained a single step further, and with many a teacher it has yet to be taken in the full round of the science work, the *requirement of original thought from the student* as well as original expression of thought. To require of students in our secondary schools in study of any science nothing further than mastery of the thought of an author as expressed in the text book is neither the most complete nor the most profitable mental activity.

Allowing that we have in books veritable storehouses of the riches of ages of human experience, thoughts that are profound, language that is grand, thought expressions to whose depths and to whose heights we may scarcely hope to attain, expressions that may tax to the uttermost our endeavors of a lifetime to rethink them, humble travelers as we are over well marked mental highways and byways—allowing all this, it is contended that the great mass of books put into the hands of our students are *not of this character*, and that the writers of modern text-books for secondary schools are few who seek to do other than to put before the student in the simplest, most elementary manner possible the facts of the subject treated. It is the facts themselves and the manner in which they are presented that is of prime importance. Any course in science that stops short of requiring original thinking by the student, thinking that is based upon facts that are leavened through and through with the results of personal observation and investigation must needs be comparatively barren of mental growth and vigor.

The logical result of such views is to regard the text-book in science as a reference book in simple compact form, furnishing what shall be needed to supplement the results of the student's own efforts in observation and thought—a reference book differing not a whit in purpose from the other reference books found in any well appointed laboratory save in its larger use and *that it is the students'* own.

Happily the day was soon past when the science student of our secondary schools was looked upon as a discoverer, as one who by his unaided efforts was to re-establish the laws, principles and theories of the subject he pursued and all this as a result of his own investigations. the story of Agassiz, his student and the fish, was made to teach preposterous lessons. In most of the sciences the limits of original investigation are well defined, the need and use of text and reference books well established in supplementing laboratory work. In astronomy [and meteorology], however, oldest of the sciences, science of the material universe, the student is too often expected to know nothing save what his author tells him, to cultivate no mental powers in its study save the taxing of an already over burdened memory; or, at most, his powers are taxed in making out what the author means in his text, and through the exercise of the imagination in picturing what the author describes as existing.

In any attempt to apply the laboratory method to the teaching of astronomy [and meteorology] there is the same necessity as in the other sciences that no time be wasted upon comparatively unimportant phenomena; that observation shall be so carefully directed as to readily acquire the desired facts; and that these results shall be so related as to make generalization possible. That there are difficulties in the way is true, but they may largely be included under these heads: (1) A failure on the part of many teachers to appreciate the fact that although many of the phenomena of astronomical [and meteorological] science require apparatus too expensive and too complicated to be available, and although many of the conclusions are reached through reasoning too abstract to be within the comprehension of the students to be instructed—there still is wide range for observation and inference fully within the comprehension of pupils of high school grade: (2) The text-books in astronomy [and meteorology], with but an exception or two, not only tell all the facts that the student can easily acquire for himself under direction as well as those beyond the range of his ability and opportunity, but, withal, their pages are crowded with ready made inferences from these facts, making it wholly unnecessary for the pupil to do any thinking himself beyond that involved in language interpretation. He may study astronomy and complete his course, but still has no more knowledge of the relation of his work to celestial phenomena than one who studies the bookkeeping of the high school instead of the actual business conditions it is supposed to exhibit. Science teaching in any grade of school work should surely not make memory and imagination a first consideration—observation and thinking a secondary matter.

When teachers of astronomy [and meteorology] shall be content no longer to instruct in this science upon a basis so radically different from that of the generally recognized laboratory sciences, and shall demand for laboratory reference text books that are filled with facts clearly and logically arranged, and having terse statements of the theories advanced therefrom, together with such descriptions and explanations as are beyond the ability of the average student for whom they are written, but which at the same time are free of all such matter as may properly be required of students as the result of their own observation and thinking—when teachers shall demand that guides and manuals for the study of astronomy [and meteorology] shall be furnished even as in physics and in chemistry, to the end that like principles of instruction and of laboratory procedure may be applied to all alike—then, and not till then, will publishers come to the relief of such teachers as already seek to secure in the teaching of astronomy [and meteorology] in secondary schools the fullness of its possibilities for mental development, even as with other sciences, in addition to its value otherwise so fully recognized.

THE RECURVING OF HURRICANE TRACKS IN THE NORTH ATLANTIC.

The Pilot Chart for November, published by the United States Hydrographic Office, gives a diagram showing the path followed by the centers of twenty-five tropical cyclonic storms in the North Atlantic Ocean during the ten years, 1890–99. Concerning these Mr. James Page, of that office, makes the following remarks:

Of these storms Nos. 2 and 9 each pursued a course trending between north and west, the former crossing Florida into the Gulf of Mexico, the latter disappearing over the mainland in the vicinity of Charleston. The course of Nos. 10 and 16 was in a northeasterly direction throughout, although it is probable that the complete history of these storms would show an earlier movement toward the northwest. The absence of observations, however, precludes in either case any attempt to represent this earlier portion of the track. No. 20 followed an almost due northerly course, keeping well under the coast, and No. 21, although the barometric depression accompanying the storm originated in the Gulf of Mexico, failed to attain full hurricane violence until reaching the position indicated.

The remaining tracks exhibit the usual features, the motion of the storm center in that portion of the track to the southward of 25° being directed toward a point between north and west, recurving at some point situated in general between 25° and 35°, and thence moving in a northeasterly direction. The position of this point of recurvature, or point of greatest westing, is given in the following table, in which the storms are arranged with reference to the date of recurving, without regard to the year:

Location of recurvature.

No.	Year.	Date.	Lat. N.	Long. W.	No.	Year.	Date.	Lat. N.	Long. W.
			° ′	° ′				° ′	° ′
7	1892	Aug. 19.....	28 30	67 30	17	1896	Sept. 22....	30 10	74 45
8	1893	Aug. 20.....	29 00	76 00	11	1894	Sept. 25....	25 16	82 12
3	1891	Aug. 28.....	36 00	64 00	18	1896	Sept. 28....	25 00	85 00
1	1890	Aug. 29.....	29 00	70 12	6	1891	Oct. 5.....	39 00	68 06
24	1899	Sept. 1	30 20	72 20	12	1894	Oct. 8.....	27 48	88 12
4	1891	Sept. 6	33 30	72 48	19	1896	Oct. 10.....	29 00	76 10
25	1899	Sept. 11	28 00	68 10	13	1894	Oct. 15.....	23 00	68 00
23	1899	Sept. 13	28 00	80 10	15	1895	Oct. 20.....	20 30	82 48
22	1898	Sept. 17 ..	30 00	71 10	14	1894	Oct. 24.....	26 10	75 00
5	1891	Sept. 21 ...	32 30	64 36					

From this table it will be evident to the masters of vessels frequenting West Indian waters and exposed to the violence of West Indian hurricanes that to rely upon the assertion that the storms of a particular month recurve within certain fixed and narrow limits of latitude may lead them into serious error at a most critical time. Thus the table shows that the hurricanes of September, instead of recurving between 27° and 29°, as formerly maintained, may in actual practice recurve in any latitude from 20° 20′ N. to 33° 30′ N.; likewise those of October, instead of recurving in latitude 20° to 23° N., may continue their northwesterly course until the parallel of 30° is attained.

The mariner, like the forecaster, must always be on his guard against unexpected departures from normal types of storms and weather.

METEOROLOGY IN THE SCHOOLS.

Occasionally we are cheered by discovering an additional enthusiastic voluntary observer and teacher. The following letter from such an one breathes the right spirit and is worthy of record:

Two weeks ago we received notice from the Central Office that if we would contract to keep an unbroken series of observations, the Weather Bureau would establish a voluntary station at our college. Matters were soon arranged so that this would be possible, and the instrument shelter, rain gage, maximum and minimum thermometers, and record blanks have been received. As soon as the shelter can be put in place we shall begin regular observations. The college has purchased from Friez a barometer, barometer case, and sling psychrometer, all of which arrived on Saturday. The barometer is now hanging in the library, where it can be seen by all, and as soon as our classes in physical geography are well started there will be an intelligent interest taken in this instrument. Last night I explained its general principles to our librarian, who had never seen one before and had no idea of its construction or object.

I find that in order that this institution may be the general source of broad instruction that it ought to be, some one must take hold of those sciences in which I happen to have a general interest. I want this college to be an inspiration to the public school teachers in the State and their central authority for teaching and training in science. Our president feels an interest in meteorology and allied subjects, and we ought to be able to develop them here. I am introducing more laboratory work into this year's courses, but all our work must be of an elementary character as compared with that of the great universities.

If we science teachers at this place are to make the best of our opportunities to acquire an influence along educational lines, we must struggle against the natural tendency toward narrow sympathies; we must avoid too much specializing; we must give our pupils such instruction as will enable them to take an intelligent, because a practical, interest in all the important lines along which human knowledge is developing to-day. One of the reasons why we endeavored to secure a voluntary station at this college was the conviction that an every day acquaintance at first hand with the methods, instruments, and phenomena of meteorology will lead our students to acquire a truer and more sympathetic appreciation of the work of the U. S. Weather Bureau.

The daily map from our State center is displayed on a bulletin board in our front hallway, and in January the State section director is to give us a talk on practical meteorology.

REPLIES TO CORRESPONDENTS.

A correspondent sends the Editor a series of questions such as may possibly have occurred to others among our readers, and we therefore submit a portion of the reply for their information.

Violent thunderstorms visit the regions within 30 miles south of the St. Lawrence River during a great part of the summer. Three years ago, namely, in March, 1896, a "cyclone," as it is called by the country people, struck our place, throwing down barns, carrying a child several hundred yards, etc. From all I learn the tornado came from the west. In the face of all this, I want to know:

1. Is this region not supposed to be exempt from tornadoes?
2. Do not the mountainous features of the locality tend to break up the motion of the tornado?
3. Is the tornado more likely to strike places on an elevation than those in a valley or near a river?
4. Is an isolated house in the country safer with, or without, a lightning rod?
5. Is a stone house safer than a wooden one? The country people say that lightning kills the fruit of plum trees, singles out the fir tree for its shafts, but will never strike a beech, and that brilliant "northern lights" presage a storm. Is there any truth in these sayings?

We have no exact observational data relating precisely to all the matters involved in these questions, but it is allowable oftentimes to reason by analogy from what we know to that which would probably happen under analogous circumstances.

1. The northern limit of tornadoes has not yet been fixed by observations, but the data from Canadian, and especially United States Weather Bureau stations, would lead to the conclusion that along the southern bank of the St. Lawrence River one tornado is likely to occur within a region of 10,000 square miles, or 30 miles wide by 333 long, about once in ten years (see MONTHLY WEATHER REVIEW, Vol. XXV, p. 250). But the storm alluded to as having occurred in March, 1896, was probably not a tornado. The fact that the country people called it a "cyclone" has nothing whatever to do with its true character and simply shows that they do not understand the meaning of that word. A tornado is not only a violent wind, but one accompanied by a peculiar cloud formation. The under side of a cloud appears to suddenly extend downward to, or near to the earth, and this cloud column is seen to be in rapid rotation. It is not made up of an ascending mass of dust or water, but it is ascending air within which the cloud formation stretches downward. Those who do not actually see such a funnel-shaped cloud should call the storm a gust of wind or a violent wind, but not a tornado, and still less a cyclone. Winds that are violent enough to carry men and animals along horizontally, in spite of their own wills, may occur in connection with hurricanes and blizzards, but do not of themselves constitute tornadoes.

2. A mountainous locality is not apt to have a tornado. Severe thunderstorms of wind and cloudbursts of rain may occur, but a genuine tornado is almost unknown among high mountains. The reason for this is not because the mountains tend to break up the motion of the tornado, but rather because the mountains facilitate the formation of smaller and less violent windstorms, and because mountain air is cooler and drier, so that the atmosphere has no chance to pile up the great cumulus clouds, beneath which the tornado is formed.

3. A tornado often rises and descends alternately. The surface winds rush toward the low pressure within the funnel, and wherever the funnel cloud itself descends to the ground or near it there the great injury is done. Available statistics are not very clear as to whether a hill several hundred feet high can break up a tornado temporarily. Along the path of a tornado there are always some regions of greater and others of less destruction; in the latter the tornado funnel has simply risen above the ground, and such rises have no clear connection with hills and valleys. They probably depend almost entirely upon the mechanical actions going on overhead within the cloud, from which the tornado draws all its power.

4. Isolated houses are safer from strokes of lightning when properly protected by lightning rods. The great difficulty is to tell what is a proper protection from lightning.

5. So far as concerns fire due to lightning, the stone house and the slate roof are far preferable to the wooden house and the shingle roof. Metal roofs and rain spouts may be still better. The country proverbs as to the lightning singling out certain kinds of trees are based upon an insufficient number of observations. All available statistics that have been gathered show that no one kind of tree has a greater immunity than any other. When a lightning flash passes from the cloud to the earth, the conductivity of the soil and the strata below it have decided in general where the flash will strike. The characterstics of the soil and its water contents also decide what trees will best grow there. The difference in conductivity of various kinds of wood is not so important as the height and size of the tree, and the prominence of its location and the wetting of its trunk by rain.

6. The northern lights frequently appear in advance of a storm, but still more frequently after it, and have no real value in forecasting the occurrence of storms.

THE BAGUIOS OF THE PHILLIPINES.

In the translation of an article by Dr. Bergholz, which we published on page 402 of the September REVIEW, we have used the words "hurricane" and "typhoon" as synonymous, but strict adherence to the rules that the Editor has often defended would require that we either use the word "cyclone" uniformly for all revolving storms, or else use the names that have a widespread local usage. It is generally recognized that the word "hurricane" should, at least in English works, be restricted to the violent storms of the Atlantic, as it has its root in the Carib word "ourgan," from which the French have derived their "ouragan," the Germans their "orkan," and the Spanish their "huracan." The word "typhoon" has for unknown ages been applied to the revolving storms of the Indian Ocean and the China Sea.

The famous work by Algué, Baguios ó Cyclones Filipinos, brings to our attention the name that is universally applied in the Philippine Archipelago to the storms that, after they pass westward over the Archipelago, become typhoons on the coast of China. As to the origin and pronunciation of this word, Prof. Dean C. Worcester, the well-known authority of the Philippine Islands, writes as follows:

> I can not tell you to what dialect the word "baguio" belongs. It is certainly the word used for typhoon by both the Tagalogs and the Viscayans, and I fancy it is of Malay origin, but that is a guess pure and simple.
>
> As to the pronunciation, the "a" is as in barn; the "gui" is precisely equivalent to the "gi" in the "git" of our New England dialect; and the "o" is as in our "oh." The accent falls on the first syllable.

THE BEN NEVIS OBSERVATORY.

We condense the following items from an article in a recent St. Louis newspaper. Ben Nevis is located about 60 miles north-northwest of Glasgow, Scotland, and its altitude is given as 4,133 feet. For many years past two stations have been maintained, one at the summit, the other near the base, under the auspices of the Scottish Meteorological Society, which has secured the necessary voluntary contributions and an annual allowance from the government funds, as administered by the British Association for the Advancement of Science. During the first year of its existence the observations were made daily by Mr. Clement Wragge, now the Director of the Meteorological System of Queensland, Australia. In his day there was no residence for the observer at the summit, and he made a daily trip from the lower station to the upper and return on foot. At the present time a movement is being started to have the Ben Nevis observatories accepted as a government institution. Their usefulness for the scientific study of meteorological problems is universally recognized, but the value of the records from the upper station for use in weather forecasting are still to be demonstrated. It is one of the few localities where hourly observations are made simultaneously at both a high and a low station in order to deduce the average density of the intermediate air.

The summit of the mountain is always wreathed in snow, and perpetual fog overhangs the observatory. When the observer starts out for his first observation he takes with him an empty rain gage; this is changed for the one that has been out during the previous hour, which is covered up and taken back to the observatory. Having climbed by a ladder to the roof of the observatory, the observer faces the wind as squarely as possible, after which he records its apparent direction and velocity for comparison with the records of the self register. The quantity, kind, and direction of the clouds on all sides are then recorded, as also the presence and extent of the mist or fog. If the mist is absent, the observer may have an inspiring view of Scottish scenery. After returning to a lower story of the observatory tower, he, by means of John Aitken's dust counter, records exactly the number of dust particles in a cubic centimeter of air; he then descends to the office and measures the rain or melted snow. The observations are all recorded on slips of paper and afterwards copied on the daily sheets which contain the twenty-four hourly observations. In the winter time the thermometer screens, the rain gage, and other apparatus have to be kept clean of drifted snow, or dug out of the snow drifts, and often taken to the house to be thawed out, in which latter case a new set of thermometers is temporarily set up in the shelter.

THE SEVENTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

This Congress sat in Berlin from September 28 to October 4, and was preceded and followed by a series of geographical excursions to different parts of Europe. Among the resolutions adopted by it are the following, which have a special interest for meteorologists, (see Nature, October 26, 1899, p. 633):

2. The Congress believes that the plans for international cooperation in Antartic exploration form an excellent basis for joint research in physical geography, geology, geodesy, and biology. With regard to meteorological and magnetic work, however, it appoints an international committee to determine the general scheme and methods to be employed on the expeditions, and to endeavor to organize a system of simultaneous observations in the regions surrounding, but exterior to, the Antarctic.

3. The Congress expresses the earnest desire that all maps, including those published in countries using English and Russian measures, should, in addition to the graphic scale, bear the proportion of lengths on the map to those in nature in the usual form $1:x$.

6. The Congress expresses the hope that in scientific publications the centigrade thermometer scale will, as far as possible, be employed; or, at least, the values in centigrade degrees be added to those expressed on the scales of Fahrenheit or Réaumur.

10. The Congress considers the collection of data as to the distribution of floating ice to be very important, and appeals to the hydrographic and meteorological institutes of the countries whose ships frequent high latitudes to induce the masters of vessels to keep a regular record of the occurrence of drifting ice. The Congress believes that the Danish Meteorological Institute in Copenhagen is the best adapted as an international center for collecting the records.

11. The Congress nominates an international committee to consider the nomenclature of the floor of the ocean, and to produce and publish at latest in time for the next Congress a chart of the ocean with revised nomenclature.

12. The Congress hopes that the names of oceanic islands, especially in the Pacific, will be revised with a view to ascertaining and preserving the native names. Where no native names exist or can be ascer-

tained, the names given by the discoverers should be used. The arbitrary changing of established names ought to be opposed by every means.

15. The Congress is favorable to the foundation of an international seismological society, and appoints an international committee for the study of earthquakes.

THE WEATHER REVIEW AND THE HIGH SCHOOLS.

During the past year the Chief of the Weather Bureau has received an unusually large number of requests for copies of the MONTHLY WEATHER REVIEW and other publications of the Bureau; so many, in fact, that it has become difficult, if not impossible, to accede to them all. One can but suspect that the great stimulus given to the study of meteorology by the widespread introduction into progressive high schools of the beautiful works on physical geography by Davis, Tarr, and others has led to this increased demand upon the resources of the Weather Bureau.

Professor Moore is very desirous of encouraging the study of our science, and is quite willing to respond to requests for publications whenever practicable; but, as the editions are soon exhausted, he takes the liberty of suggesting that voluntary observers and, indeed, all who have received copies of the MONTHLY WEATHER REVIEW, or any other publication of the Bureau, will do him a favor if, after using such public documents, they will kindly deposit them in the library of some college or high school, or in some public library, where they may be accessible to others. Those who prefer may, of course, return them to the Weather Bureau by mail, for which purpose penalty envelopes will be provided.

It often happens that a school or teacher, or other applicant for the MONTHLY WEATHER REVIEW, is in the same town where a voluntary observer also lives. Now, the edition of the MONTHLY WEATHER REVIEW already approaches the limit imposed by our annual appropriation for printing, so that requests for copies are often necessarily refused. In many such cases the local voluntary observer may be glad to put his set of the publications of the Weather Bureau at the disposal of the teachers and schools. If the teachers would also call upon him for popular talks to their scholars on the art of observing and the results of his local observations, he could doubtless give them such a talk on local weather lore as would prove highly instructive. A visit by the school to the voluntary station and a personal inspection of the thermometers and the rain gage would be an object lesson of permanent value to the youth. The regular Weather Bureau stations, whose records appear in Table I of the MONTHLY WEATHER REVIEW, are always ready for such visits, and the observers will, we are sure, always be glad to do what they can to explain our work to the scholars and teachers.

SAVE YOUR SETS OF MONTHLY WEATHER REVIEWS.

In the monthly section reports mention is frequently made of deaths or other changes among the voluntary observers. In such cases the thermometers and the rain gages are sometimes forwarded to the section center, for use by other observers; sometimes they are transferred to a successor in the same town; but what becomes of the files of MONTHLY WEATHER REVIEWS? These are greatly in demand by schools and colleges, and should be carefully preserved. Unfortunately the Weather Bureau can not undertake to call them in and return bound volumes in exchange, or it certainly would do this in order to insure their preservation. But any observer who has a mind to keep the REVIEWS in good condition can do so by tying them up between two squares of thick pasteboard.

We hope that the section directors and voluntary observers will cooperate in preserving the REVIEWS and transferring them to those who will preserve and use them. Penalty envelopes can be supplied when the REVIEWS are to be sent by mail from place to place.

BACK NUMBERS OF THE MONTHLY WEATHER REVIEW.

In continuation of the notices on page 109 of the MONTHLY WEATHER REVIEW for March we add the following:

Mr. W. J. Gull, voluntary observer at Cedonia (formerly Hunters), Stevens County, Washington (latitude, 48° 10′ N.; longitude, 118° 3′ W.; altitude, 4,000 feet), states that he is willing to consider any proposition from a responsible library, college or scientific institution looking to the deposit with it of his set of MONTHLY WEATHER REVIEWS, and possibly also his original records as voluntary observer. It is, of course, preferable that this data should be preserved somewhere within the State of Washington and most appropriately at the county seat. Cedonia is an interesting station, not only on account of its altitude, but because of its location in the valley of the Columbia River on the western slope of a range of hills known as Summit Mines. The county seat, Colville, is on the Colville River and located about 30 miles distant to the north-northeast. The county is rich in mining and agricultural resources, it occupies the northeast corner of the State of Washington and the climatology of this region is eminently worth of special study. The snowfall at Hunters has usually been one of the heaviest on record within that State, whereas the total annual rainfall is comparatively small; this contrast is undoubtedly due to the altitude of the station, 4,000 feet, which is the highest in the State. Cedonia is within the region of specially high precipitation in the western part of the State.

Any institution desiring Mr. Gull's set should correspond directly with him.

Mr. Barry C. Hawkins, Highlands, Macon, N. C., states that he has come into possession of a number of copies of the MONTHLY WEATHER REVIEW for May, June, July, December, 1882; all of 1883; all, except July, of 1884; the Annual Reports of the Chief Signal Officer, for 1880, 1881, 1882, which he offers to exchange for other works on meteorology, especially Greeley's American Weather, Waldo's Elementary Meteorology, or Russell's Weather and Forecasting.

Dr. Paul Bergholz, Director of the Meteorological Observatory, Bremen, Germany, desires the following volumes and numbers in order to complete his set: 1873–1882, entire; 1888–1891, entire; 1892, August, September, November, December, and the Annual Summary; 1894 April and November; 1896, May; 1897, January.

The Library of the National Astronomical Observatory at Tacubaya, Mexico, desires the MONTHLY WEATHER REVIEW for November, 1891, in order to complete its set.

All those who are willing to deposit their sets of the REVIEW and other publications with the Weather Bureau for use in completing the sets that are preserved in colleges and libraries are requested to do so.

HEAT RADIATION OF THE STARS.

As every one knows, meteorology deals only with the heat received from the sun and its action on the earth and atmosphere. Those who believe in the influence of the moon and stars have never been able to show that these exert any appreciable influence on meteorological phenomena. The refinement to which scientific measurements have been pushed, and the exceeding minuteness of the heat effects, if any, are well shown in the following article by Prof. George E. Hale, quoted from Popular Astronomy.

In an important paper published in 1890,[1] Prof. C. V. Boys describes his unsuccessful attempts to detect heat radiations from the stars by means of an exceedingly delicate radiometer used in conjunction with a 16-inch reflecting telescope. In spite of the fact that his apparatus was sensitive enough to show the heat equivalent to that of a candle 1.71 miles away, no effect whatever could be obtained from Venus, Jupiter, Saturn, Mars, Arcturus, Capella, Vega, or any of the numerous bright stars observed. After discussing the earlier papers of Huggins[2] and Stone,[3] Professor Boys concludes that the heating effects of stars, obtained many years ago by these observers with comparatively insensitive apparatus, were spurious.

The work of Dr. E. F. Nichols, Professor of Physics in Dartmouth College, in perfecting the radiometer, and adapting it for the measurement of heat radiations, has placed astrophysicists in possession of an instrument which for certain purposes is superior to the radiomicrometer, bolometer, or most improved form of thermopile. In view of the remarkable sensitiveness of the radiometer and its suitability for stellar work, Professor Nichols was invited to make an attempt to detect stellar heat radiations with its aid at the Yerkes Observatory, Williams Bay, Wisconsin. The investigation was accordingly undertaken in July, 1898.

The experiments were made in the heliostat room of the Yerkes Observatory, where the radiometer, stably mounted upon a heavy pier, could be shielded from air currents and other sources of disturbance. The great steadiness of the reflected image of the scale, making it possible to record deflections to tenths of a millimeter, was doubtless due to this arrangement.

The radiometer, constructed by Professor Nichols especially for these experiments, essentially consists of a suspension system formed of two mica discs, each 2mm. in diameter, blackened on one face, and supported by a light cross-arm on either side of a thin glass staff, hung by an exceedingly fine quartz fibre in a partial vacuum. Both vanes were exposed to the radiation of the sky, at the focus of a silvered glass mirror of 24 inches aperture and 8 feet focus, made by Mr. G. W. Ritchie, optician of the Yerkes Observatory. Rays from the star were reflected into the concave mirror by means of a siderostat[4] having a large plane mirror of silvered glass. After reflection at the concave mirror and also at the surface of a small flat one fixed at an angle of 45° with the optical axis, the rays entered the radiometer through a fluorite window.

With this apparatus a deflection of 0.1 mm. would be given by a candle 15 miles away, assuming total reflection at the silvered surfaces and neglecting atmospheric absorption. When the moon's image is made to fall on one of the vanes, the scale is instantly thrown out of the field of view. Prosessor Nichols' radiometer is about five times as sensitive as Boys' radiometer, and the area of his telescope mirror is 2.4 times that of the mirror used by Boys. In Professor Nichols' apparatus there is, however, one additional reflection.

Seven determinations of the heat radiation of Arcturus, made on August 4, 5, 7, 8, 9, 11, and 13, gave a mean deflection of 0.60 mm. Each evening's determination is the result of from 21 to 47 deflections, and the probable error of the corresponding means ranges from 0.08 mm. to 0.17 mm. Vega was also observed on seven nights, and gave a mean deflection of 0.27 mm. The ratio of the heat radiation of Arcturus to that of Vega, determined on five nights, is 2.1, 2.0, 3.0, 2.3, 1.0;[5] mean, 2.1. These results are not corrected for atmospheric absorption.

In all cases the observer was ignorant of the probable direction of the deflection, and other precautions were taken to avoid bias. The results appear to be trustworthy, and the probable errors are not greater than might be expected in such observations. In view of the smallness of the deflections and the uncertainty which arises from the rapid fluctuations in the atmosphere, Professor Nichols does not greatly rely upon the quantitative value of the results. They may fairly be considered to show, however, that we do not receive from Arcturus more heat than would reach us from a candle at a distance of five or six miles, no account being taken in the latter case of atmospheric absorption.

[1] Proceedings of the Royal Society, vol. 47, p. 480, 1890.
[2] Ibid., vol. 17, p. 309, 1869.
[3] Ibid., vol. 18, p. 159, 1870.
[4] Kindly loaned by the Allegheny Observatory.
[5] Sky very hazy.

THE FIRST VOLUME OF THE MARYLAND WEATHER SERVICE.

The publication of the first volume of the Maryland Weather Service marks quite an interesting epoch in the history of the development of the State weather services of this country. In so far as independent State services are maintained, their directors must necessarily develop and apply their energies in those directions that will best tell for the interests of the States. In this respect, Maryland has been highly favored. Prof. Dr. Wm. B. Clark, who founded the State weather service, and secures its annual appropriations from the State Legislature, has also received such hearty cooperation from the Chief of the United States Weather Bureau that we have here practically two institutions working side by side in complete harmony, viz, the Maryland Section of the Climate and Crop Service of the United States Weather Bureau, of which Mr. F. J. Walz is Section Director, and on the other hand, the Maryland Weather Service of which Professor Clark is director.

The Maryland Section is maintained entirely by the United States Weather Bureau, and does all the expensive routine work that is performed by similar sections throughout the country. The Maryland Weather Service expends its energies in developing a greater interest in meteorology, lecturing and teaching and stimulating the production of special memoirs, which it proposes to publish in the magnificent style of which the present first volume is an illustration. Nothing like this, in the way of paper, presswork, illustrations, and typography, so far as we know, has ever before been published anywhere in the world in the interests of meteorology. Such a magnificent volume commands admiration from all who have any bibliographic taste, as well as from those who are interested in the scientific subject-matter.

The idea of devoting the energies of the local State service to memoirs rather than to daily, weekly, monthly, and annual bulletins and reports is a highly important step in the development of our science. For a century past, well established astronomical observatories had been famous for publishing great volumes of figures, showing the results of actual observations and stars, when, about 1840, Struve announced that the new observatory at Poulkova would publish memoirs as fast as they could be properly prepared, but would not, for the present, publish annual volumes of observations. In meteorology, as in astronomy, all important progress must be embodied in the memoirs that contain the results of the investigations of able physicists. As preliminary to these, observations and minor studies must be made and published. Every brilliant memoir that marks the upward pathway of science has been preceded by years of less brilliant work—the so-called "grind" of daily routine. After clearing away the errors of the past, it becomes possible to obtain new and more correct views, just as one cuts down the forest in order to let the sunshine in. We understand that the succeeding volumes of the series that Professor Clark has thus happily begun, will be devoted to monographs on meteorological and climatological matters intimately connected with the commercial, financial, and agricultural welfare of Maryland. This implies that he will secure a high grade of employees as investigators and statisticians, in order that the subject-matter may command as high a degree of admiration as does the typographical aspect of the volume. It is evident, therefore, that in future we must look to Maryland and its weather service as one of the most successful patrons of high class work in meteorology.

Among the many words of praise for this first volume we quote the following:

J. R. Sage, in the Monthly Review of the Iowa Weather and Crop Service for October, says:

The board of control is composed of William Bullock Clark, director, representing the Johns Hopkins University; Milton Whitney, secretary and treasurer, representing the State Agricultural College, and Ferdinand J. Walz, meteorologist, representing the United States Weather Bureau. By means of a liberal State appropriation to cover necessary expenses, and a wisely devised system of cooperation, these three great scientific and educational forces are doing a great work for the people of that commonwealth. * * * * * *

In the production of this great work the Maryland Weather Service has taken the lead of all similar auxiliary services in the Union, demonstrating the value of cooperation of the State with the National Bureau in the dissemination of scientific and practical knowledge among the people. Every State in the Union may wisely follow that lead by establishing some system of cooperation whereby every section may enjoy the full measure of benefits to be derived from the generous helpfulness of the Government.

Mr. Alexander McAdie, in the October report of the California section, says:

Maryland now enjoys the result of a well-considered plan, worked out with care by competent laborers. * * * * * *

It is clearly shown in a volume of this character that a knowledge of the climatology of a country is of great practical value to the merchant, engineer, the doctor, and, above all, the farmer. What such information is worth on the Pacific coast let agriculturist, miner, stockman, and engineer tell. Particularly at this time, when the Pacific seems destined to become the great connecting link between the civilizations of the new and old worlds, is it important that we should have climatic information complete as knowledge, skill, and means can afford. Meteorology may be, as sometimes stated, "the border land where physics, chemistry, and geology meet;" but climatology in the broadest sense embraces all the applied sciences. It weaves together many separate strands into a knowledge of the controlling factors of life; not only the life of an individual, a community, or a nation, but even of continents and worlds. A study of the climatic data of the Pacific coast as comprehensive as this work which issues from Maryland would be the starting point in the solution of the problems of climatic evolution which are discernible on the Pacific coast perhaps in a more marked degree than elsewhere.

Mr. R. DeC. Ward, in Science for December 1, says:

A new era has opened for climatology in this country. * * * The present volume is decidedly "*bahn-brechend.*"

THE DIRECTOR OF THE IOWA WEATHER AND CROP SERVICE.

We quote the following from the October report of the Iowa Weather and Crop Service. As is well known this service, like that of Maryland and some other States, has an independent appropriation of its own, and its monthly review has been a most valuable contribution not only to scientific literature, but especially to the popular literature of this subject. Its trenchant attacks on errors and instructive articles and practical suggestions on matters of daily importance have made the journal and its editor well known throughout the country. We welcome him as a valuable addition to the corps of the Weather Bureau, with which he has so long been in hearty cooperation.

By a special order of the President the director of the Iowa Weather and Crop Service was recently brought into the classified service, and was appointed by Secretary Wilson a section director of the Climate and Crop Service of the United States Weather Bureau, said appointment taking effect October 1, 1899. This honor is most highly appreciated because of the fact that it came without personal solicitation or political influence, accompanied by very pleasant messages from the Secretary of Agriculture and the Chief of the Weather Bureau, commendatory of the work that has been done in Iowa during the past ten years. This appointment does not imply any change in the existing system of cooperation of the United States Weather Bureau and the Iowa Weather and Crop Service, except that it may enlarge its scope and make the bond of union closer and more effective for good results. It is certain that the results achieved during the past decade have been more valuable than could have been secured without such cooperation, though justice requires the statement that the National Weather Bureau has been the major factor in this joint enterprise. The State, through its moderate appropriation, has undertaken to supplement the Government along practical lines, thereby securing a larger measure of the benefits of scientific investigation, and promoting a general knowledge of the climatology of this great agricultural section. How well this beneficent end has been attained the people of Iowa may be allowed to judge.

RAINFALL AND RIVERS IN IDAHO.

In his October report of the Idaho Section, Mr. S. M. Blandford, Section Director, gives some account of the discharges of the rivers during 1898. He says:

All of the rivers of Idaho that have received the attention of the Division of Hydrography have their source in the mountains of Idaho, except the Snake River. The drainage area of the Malade, Little Wood, Boise, and Weiser rivers is 7,580 miles, and with the exception of the Payette, embraces all of the important rivers that flow into the Snake from the north. * * * * * *

The normal precipitation in Idaho ranges from 40.30 to 8.41 inches. In Shoshone County the annual precipitation, 40.30 inches, is equivalent to that of southern Maryland, and the precipitation of Kootenal and Latah counties, which ranges from 22 to 25 inches, is sufficient for the needs of vegetation. In Fremont and Bear Lake counties, and the eastern sections of each of the southeastern counties, grains and grasses mature on unirrigated lands during years of normal precipitation with an equitable distribution of rainfall during the crop growing season. However, more than seven-tenths of the area of Idaho is semiarid. It is in the semiarid sections where the annual precipitation ranges from 9 to 15 inches over the valleys and plains, to 20 and 27 inches near the summit of the mountains, that the Division of Hydrography has made river discharge measurements. During 1898 the annual precipitation over the drainage area of the rivers in the above table [omitted] was considerably less than the normal, the deficiency ranging from 1 to 5 inches.

THE CENTRAL OFFICE OF THE ILLINOIS SECTION.

It is announced that the central office of the Illinois Section of the Climate and Crop Service was removed on November 25 from Chicago to the office of the United States Weather Bureau at Springfield, Ill. The Section still continues in charge of Mr. Charles E. Linney, Section Director. In general, it is found best that section centers should be at the capitals of the respective States, and we doubt not that in his new location, which well represents the climate and the agricultural interests of Illinois, Mr. Linney will come into those intimate relations with the farmers and the legislators that were not easily attained when he was located within the influence of the rush of commercial business in Chicago. By thus establishing two meteorological centers within the State, the light of knowledge will, doubtless, be more uniformly diffused.

IRRIGATION BY WIRE.

In the continuation of the correspondence published on page 301 of the MONTHLY WEATHER REVIEW for July, Mr. Arthur Betts writes, under date of October 17, as follows:

In reference to the statement that "the 0.13 inch of dewfall was more than twelve times that amount by wire (1.58 inch)" bear in mind that I did not catch the one forty-ninth part of the drip from the wire. The largest part of the drip was wasted on the ground beneath. To have caught it all would have required a basin 7 feet square and 1.58 inch deep. A closer network of wire would have increased the amount of drip. Perpendicular wire would not answer. A horizontal wire 1 rod long would irrigate every inch of the rod, but when hanging vertically, only a little spot.

The following extracts are taken from a letter addressed to Mr. Arthur Betts by Mr. A. D. Elmer of Northfield, Mass., and communicated by the former to the Editor for publication in the MONTHLY WEATHER REVIEW:

An unusually heavy fog occurred here, at Northfield, Mass., on the night of October 25–26th. Our fog was one of the heaviest I ever knew. At present (October 26) the appearance of the higher stratum of atmosphere is one of dryness; therefore, the humid stratum is on the ground, therefore, as natural, rain must be produced above the ground, it remains for man to produce artificial rain from the fog. About 3 o'clock this morning I was awakened by the noise of drops falling from various leafless trees. There are three rain spouts conducting rain water from the north and west sides of slated roofs into a cistern and each spout was running a stream. After the sun had risen, although the fog had not gone from the surface of the ground, yet the precipitation stopped evidently because the tendency of the air was to rise upward. Therefore, fog rain must be produced on the windward side of the catch or stream. As the fog movement is either up or down and not horizontal, therefore the catching screens should be so placed as to intercept the vertical ascending or descending currents. The ground itself and its attachments, such as vegetation, buildings, etc., intercept, perhaps, one-half of what might be caught, viz, they catch only those particles of fog that are descending. Allowing that Mr. Betts' system of wire screens catches only what a similarly exposed surface in nature catches, it would appear necessary to construct, instead of one, a series of networks from which pipes could be led to the cultivated area, cisterns, etc. As this series would have to extend many feet upward into the air the first cost would be considerable, but when properly painted it should last many years. I may be pardoned for suggesting that by the introduction of electrical currents, some test might be made as to the influence of that agent in attracting and collecting cloud particles into raindrops.

In communicating the above letter, under date of November 11, Mr. Betts adds:

This letter seems to be plain proof that vertical wires will not easily catch the ascending and descending moisture in a fog or dew; the wire must be horizontal. * * * Iowa is an excellent country to experiment in, and March, April, May, September, October, November, are the best months.

The relative efficiency of horizontal and vertical wires must depend principally upon the force of the wind. In the case of the summit of Green Mountain, on the Island of Ascension, there is a steady strong wind, and the cloud particles are caught quite as well by horizontal as by vertical wires, provided they are transverse to the direction of the wind. In the still air of a foggy night in Iowa the wires would doubtless do best when they are horizontal, giving them, however, a slight inclination in order to facilitate the drainage toward a definite spot. In the fogs of the California coast the wires might have any inclination in a vertical plane transverse to the wind. It would be very desirable to investigate the total amount deposited upon a tin or slate roof and the percentage that can be made to run down the rain spouts and become useful for irrigation purposes. In most cases inclined surfaces or troughs of sheet iron or tin would probably be best. Various other suggestions are given in the REVIEWS for 1898, p. 466; 1899, pp. 100, 112, 195.

AURORAS IN TEXAS.

In the Commoner, published at Albion, Tex., September 30, 1899, Mr. D. Lee Slataper, civil engineer, publishes an account of a "rainbow" that occurred about 2:35 a. m., Sunday morning, September 17, at Alvin. It was also seen by others. Mr. Slataper says:

About 1 a. m. a storm was seen approaching from the east, very similar to the "northers" approach, with a complete line extending across the entire heavens. The storm of rain and lightning soon passed over, and the moon was seen about 30° high, in the southwest, while a heavy rain was also falling in the east. Mr. Slataper and several others now observed a complete rainbow, from horizon to horizon, with the center of the bow 45° high. The bow was of blue-gray, with silvery lining, mingled toward the ends with an almost solid purple. Its background consisted of clouds of the blackest tint possible. The colors in the bow seemed to twinkle and then fade for an instant and then reappear as bright as ever.

He desires an explanation of the causes of the change of color, from orange and red to silvery tints with blue and purple linings.

This bow of light is not likely to have been a rainbow due to the feeble light of the moon. It occurred, not only in connection with a local thunderstorm, but also in connection with an extensive aurora borealis, and it is possible that the observer really saw one of the numerous long horizontal beams of light that generally attend the aurora. The beams are nearly straight, but the effect of perspective is to give each one the appearance of an arch. The colors of the aurora borealis have not yet been satisfactorily explained.

FROSTS AND STRAWBERRY CROP.

In the October number of the Minnesota Section Mr. T. S. Outram, Section Director, publishes a letter by Mr. G. J. Kellogg, of Lake Mills, Wis., which is valuable as giving the observations of an experienced man on the actual effects of frost in that locality. Mr. Kellogg says:

A long continued cold east wind is frequently worse in its effect than frost. It will be remembered that in 1897 severe frosts continued up to June 8, and the impression was general that there would be no fruit, but the crop of small fruits was never better. In the season of 1898 there was no frost after May 6, and there was a crop as good as in the previous season, but no better.

The condition of the atmosphere, as regards moisture, has much to do with the effects of frost. If everything is dry at the time of frost there will be little injury, and if a mist comes up before the sun's rays strike the foliage, the injury will be almost nothing, unless ice has formed. * * * * * * * * *

Our most severe frosts occur when the nights are dry and still, though there is often a heavy deposit of dew on the ground the same night.

In the spring frosts never occur in cloudy weather, but the blighting east winds may do more damage at that season than the frosts.

With strawberries we find the effect of light frost is greater on the pollen anthers than on the pistils, and that often the pistillate strawberries may become pollenized before the frost occurs and give better returns than the bisexual varieties near them, hence the opinion that the pistillates are greater bearers. There is no doubt that a strawberry producing a great deal of pollen is more or less weakened by the process, but we now have such varieties as the Splendid, Lovett, Wood, Enhance, and Clyde that carry plenty of pollen and still are just as productive as any of the pistillates.

I have known frosts at 45°, but there was no injury till the temperature went below 40°.

There were sixteen days up to May 25 of this year with the temperature ranging below 42°, but there were no frosts to cause injury except on the low grounds, and the outlook for fruit was good, had not the vitality of trees and plants been reduced by the dry root freeze of the winter preceding.

WARM RAINS AND ANGLE WORMS.

It frequently happens that after a warm rain the sidewalks in the city and the fields in the country show a great number of angle worms, or so-called earth worms, crawling about on the surface, and popular ignorance speaks of a "rain of worms" as though they had come down from the clouds. Tornadoes have been known to carry up all the water of a pond and allow the fishes to drop at some distant place, but they generally are found dead. These angle worms are not at all a case of this kind. In the October number of the report of the Michigan Section, Mr. C. F. Schneider, Section Director, gives the views of Darwin, and also the theory of Dr. Kedzie, of the State Agricultural College, as to the reason for the appearance of the angle worms. Darwin says:

The worms can live for several days below water. When the ground is dry they penetrate to a considerable depth and cease to work. Their respiration takes place through the pores of the skin which requires a certain amount of moisture to keep it in an active condition. When the skin dries up the worm dies because its respiratory organs have been closed by contraction.

As to their appearance above ground after a heavy rain, Darwin says:

I believe that they were already sick and their deaths were merely hastened by the ground being flooded.

Mr. Schneider and Dr. Kedzie say:

The writer has often noticed, in this connection, that on a lawn which is sprinkled the earth worms are very near the surface, in fact, if the ground is nearly saturated with moisture near its surface, the worms are partially above ground. This brings us to the theory advanced by Dr. Kedzie, of the Michigan Agricultural College, who says that, although the earth worms can live under water for some time, it is distasteful and that the worm will not stay under water when it can get out. Dr. Kedzie advances the idea that the ground being well soaked with water and the air thus expelled the earth worms leave their burrows and come out to breathe, crawling upon sidewalks or other objects where they can get the pure fresh air.

We hope that the proper consideration of this subject will remove one more popular error from the domain of meteorology. The rains of frogs and of flesh and of blood belong to the same category. They may be phenomena of natural history but are not meteorological.

THIS YEAR'S CROP AND LAST YEAR'S GROWING SEASON.

It is natural to endeavor to trace the connection between the weather of any growing season and the resultant crop. Some years ago the Editor made a detailed study of the numerous conditions that effect the corn crop almost entirely outside of weather conditions. The conclusion was that the crop gathered from a field of corn depends so largely upon cultivation and skill in agriculture, it is so entirely an artificial product, that the influence of the weather as such is very largely obscured. It is only when a given yield per acre differs from the the normal by 25 per cent or more that we begin to get a clear insight into the influence of the weather.

The same principles apply to other crops, such as fruits, especially apples, pears, and peaches. In the October report of the Maryland and Delaware Section attention is called to the fact the orchardists of Missouri finding that the peach crop for 1899 would be a failure, soon began to cut back the trees and that this extensive pruning has brought about a splendid growth of new branches, with a prospect of a great crop in 1900. The plan of cutting back whenever early frosts have cut off a current crop is not particularly new. It has long since been applied to the vine, and in general is based upon the consideration that the best fruit comes from the youngest branches, and that if there is to be no fruit this year, then all the growing powers of the plant should be forced to bring forth fresh branches for next years crop. A tree or a vine is a storehouse whence the fruit draws its substance. If the crop fails in any given year a double amount of nutritious matter remains stored up in the body of the plant for use next year, so that if next year's season is favorable there will be an extra good crop, but if unfavorable, the storage process continues until the favorable season comes. It would be therefore quite misleading in many cases if we should attempt to define an exact relation between the weather and the crop of any particular growing season. We must study the past history of the plant for several seasons.

PROTECTION AGAINST FROST.

It has, we believe, been abundantly shown that in order to protect any extensive area of vegetation against injury by frost we must use a sufficient quantity of heat to keep the temperature above freezing for a few hours, or even days, while the danger is impending. It matters not whether the heat be used (1) to heat the air or the ground directly, or (2) to evaporate water and make a cloud of fog, or (3) to burn smudge and make a protecting cloud of smoke, or (4) whether the heat be utilized in the shape of work by engines spreading a layer of cloth or wooden slats over the field in order to shut in the heat of the soil and prevent its radiation to the clear sky, or (5) in the most interesting of all the physical processes—where water is used to moisten the soil and thereby passes from the condition of a compact mass of liquid into that of a thin capillary film surrounding every particle of soil over a large area, whereby a large quantity of latent heat is evolved; in all these, and doubtless other methods that might be mentioned, a certain adequate amount of heat must be utilized in order to counteract the tendency to freeze. The only question for the agriculturist is as to how he may accomplish his object most economically.

As regards the manner of making protective clouds of smoke or steam, or a mixture of both, several methods are given in Weather Bureau Bulletin No. 23, by Mr. W. H. Hammon, On Protection from Frost, but there are times when the simple direct heating of the air or the ground is also to be recommended as an economical process.

THE WEATHER AND THE DAIRY.

In a recent number of the report of the Virginia Section, Mr. E. A. Evans gave some results of his own observations on the effect of a fall in the temperature of the air, as causing a diminution in the yield of milk. He returns to this subject in the October report where he prints a further discussion from the Southern Planter. It appears that the practice of allowing cattle to stay in the fields or open pens all night during the winter months is productive of great loss to the farmers of the Southern States. * * * The food fed to the animals is first used in maintaining life and animal heat and only the surplus goes to the production of increased flesh or milk. The effect of a fall in temperature is to cut off this surplus. From records made at the Texas station during a norther, it was shown that the first effect of the cold was to increase the yield of butter, but the continued effect was to decrease both butter and milk by 20 per cent, and the cows did not recover for several days after the cold weather.

If cows are allowed to drink ice cold water, there is a fall of 6 or 8 per cent in the yield of milk as compared with those drinking warmer water.

LOSSES BY LIGHTNING.

The Iowa Monthly Review for October publishes an excellent article on losses by lightning in 1899, by Director J. Russell Sage, from which we quote the following as being of universal interest:

A notable feature of the crop season of 1899 was its unusual number of severe storms and excessive display of electric energy. This was an especial characteristic of the season from about the 1st of May to the middle of July, during which period more than three-fourths of the reported losses by lightning occurred. May was the stormiest month, the records showing that a measurable amount of rain fell at some station in the State during every day of the month. In June there was but one absolutely rainless day for the State at large, and nearly all the severe storms that occurred in these two months were accompanied by electric disturbances, resulting in more or less damage to farm property.

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The aggregate loss of property covered by these 395 reports is $52,524, of which sum $35,194 was the total loss estimated on buildings, and $17,330 on live stock.

* * * * * * *

These reports give details of the loss of 581 farm animals from the

direct effect of lightning, and this number does not include the 109 that were cremated in buildings fired by electric bolts. Of the live stock 9 were killed in barns that were struck and not fired; the others were in yards and fields.

And we are again confronted by the fact that wire fences are directly responsible for a very large percentage of the loss of live stock in the fields. The reports show that of the 581 farm animals killed by lightning, 395, or 68 per cent of the whole number were "electrocuted," while in close contact with wire fences.

* * * * * * *

These are astounding figures, and vastly more effective and convincing than volumes of scientific theories relating to this matter. It appears that the stock growers of this State are paying a very heavy tax on their wire fences, in addition to the cost of construction. Or, possibly, these losses by lightning may not be considered a tax on that kind of fence, but rather a penalty for not constructing the fences properly, with necessary safeguards against such casualties. It is clear that some means should be devised to render wire fences less deadly, or, failing in that, they should be discarded altogether. It is believed that they may be rendered practically safe by the use of ground wires.

The fact may be noted that many of the storms of the past season have been accompanied by driving winds, with more or less hail, as well as an unusual amount of electric disturbance. During the prevalence of that class of storms farm animals in the fields seek closer companionship, and by the force of the storms are driven and crowded together in bunches or herds against the fences that obstruct their way. The reports show that many animals were killed in bunches by single strokes of lightning. * * * * * *

Nearly 30 per cent of the reports show that the strokes occurred on high and dry lands, somewhat distant from timber; and 20 per cent in or near groves or timber lots. This may signify merely that more stock is pastured on high and dry than on low, moist, or timbered lands; and also that buildings are generally erected on elevated and dry sites.

It appears to be certain that isolated trees in pastures are sources of danger to stock or persons that seek shelter under their branches, and it is probably true that dense groves or heavy timber afford a measure of protection against electric force, as well as the other elements of severe storms. The conclusion of the matter is that the safest retreat for man or beast during a thunderstorm is in a building protected by a well constructed rod or metallic roof. * * * *

I am convinced that a very large percentage of losses by lightning may be prevented, and the special purpose of our investigations should be to discover the means of prevention. An ounce of prevention is better than a pound of indemnity.

VAPOR PRESSURE FOR WATER AND ICE.

In comparing and liquefying ordinary air the atmospheric moisture makes much trouble for manufacturers, therefore the following extracts from recent correspondence may be of general interest:

My problem is to dry the air before cooling it for liquefaction by cold. The data which I can not find are those for saturation of air at high pressures and very low temperatures. The pressure in point is 1,500 pounds per square inch. What is the humidity of air at that pressure and from 60° F. down to 312° below zero Fahrenheit? At the lower temperature the pressure might not be over 300 pounds per square inch.

My idea is that the air which is taken into the machine perhaps unsaturated at the pressure and the temperature of the day soon becomes saturated by cooling, and the water vapor freezing is a source of trouble, clogging the pipes. The relation of the very high pressure employed to the relative humidity I am not so sure about, and on this I would like your opinion. Are there any tables for humidity and high pressures?

I am of the opinion that there is no way to remove the trouble but to dry the air chemically. Is air more easily dried at a low pressure, or at a high pressure?

The people using compressed air pass it through cold water, cooling it below the temperature at which it is to be used. When heated again for use it becomes unsaturated. But if it should be still further cooled instead of being heated, it would then deposit still more moisture, would it not?

The following is an extract from the reply:

The quantity of vapor, which a given space can contain, depends altogether on the temperature and only on the temperature. In your particular case we would say that the moisture per cubic foot of air at a pressure of 1,500 pounds per square inch could not be any greater than with same air at atmospheric pressure. Perhaps this broad statement needs a little qualification. Regnault measured the maximum vapor pressure in vacuo, that is, when no other gases were present, and he afterward measured this same pressure when ordinary air was present. According to some physical theories these two pressures should be the same. The very slight differences noticed in his results may plausibly be considered to be due to the slow diffusion of the vapor through the air and the difficulty of obtaining complete saturation under such circumstances. While this effect must exist in air undergoing compression, yet, we are satisfied that the statement made above may be regarded as substantially true, namely: That any given space, saturated with aqueous vapor, will contain the same amount, irrespective of any amount of air, that may be in that space at the same time. This is more particularly true, we think, in case of air subjected to compression, as the question of diffusion does not enter in the same way.

You are quite right in concluding that air undergoing compression soon becomes saturated, but not because it is cold, as a rule, but as a result of the compression itself. The air originally drawn in may not be saturated, but sooner or later, as the compression proceeds the moist vapor present is compressed to a pressure equal to the maximum pressure corresponding to the temperature at which it exists, and any further compression must cause condensation unless the temperature is increased. Of course, ordinarily, the temperature does increase, but the air is presently passed into some sort of cooling apparatus and then condensation takes place there.

In regard to drying the air artificially, the above statement indicates one way by which it can be done, viz, to cool it considerably after compression, thereby literally freezing out, so to speak, all the moisture it contains. The residual water vapor in air at a temperature of 60° below zero, for example, is almost inappreciable. In other words, such air is practically dry.

In regard to drying air chemically, I think it can be more completely dried at a low than at a high pressure. On this point I beg to refer you to the experiments made by Professor Morley, American Journal of Science (3), xxx, p. 140, and (3), xxxiv, p. 199.

Compressed air which has passed through water may be regarded as practically saturated with water vapor, and, as you say, if afterward cooled below the temperature of the water, it will deposit more moisture.

There are no tables treating of humidity at high pressures, because the ordinary tables answer the same purpose.

In addition to the previous remarks, the Editor submits the following small table, which is an abstract of the larger one published by Juhlin in the Proceedings of the Swedish Academy at Stockholm, and reprinted in the Meteorologische Zeitschrift for March, 1894, Vol. XI, p. 98. This table gives the elastic force, or the so-called tension of pure aqueous vapor in a space that is saturated at the respective temperatures. It will be seen that the pressures when liquid water is present in the inclosure are larger than when only particles of ice are present; therefore it is supposed that there are these two forms of aqueous vapor because the pressure of water is so appreciably different from the pressure in the presence of ice. The differences found by Juhlin agree almost exactly with those published by Professor Marvin in his report as contained in the Report of the Chief Signal Officer for 1891.

Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.
°C.	Mm.	Mm.	°C.	Mm.	Mm.	°C.	Mm.	Mm.	°C.	Mm.	Mm.
0	4.62	4.60	−13	1.74	1.53	−26	.....	0.46	−39	.....	0.13
− 1	4.30	4.25	−14	1.61	1.40	−27	.....	0.42			
− 2	3.99	3.92	−15	1.49	1.28	−28	.....	0.38	−40	.....	0.12
− 3	3.71	3.62	−16	1.38	1.17	−29	.....	0.34	−41	.....	0.11
− 4	3.45	3.33	−17	1.28	1.06				−42	.....	0.10
− 5	3.20	3.07	−18	1.18	0.97	−30	.....	0.31	−43	.....	0.09
− 6	2.97	2.82	−19	1.09	0.88	−31	.....	0.28	−44	.....	0.08
− 7	2.76	2.59				−32	.....	0.26	−45	.....	0.08
− 8	2.56	2.38	−20	1.00	0.81	−33	.....	0.23	−46	.....	0.07
− 9	2.37	2.18	−21	.....	0.73	−34	.....	0.21	−47	.....	0.06
			−22	.....	0.67	−35	.....	0.19	−48	.....	0.06
−10	2.20	2.00	−23	.....	0.61	−36	.....	0.18	−49	.....	0.05
−11	2.03	1.83	−24	.....	0.55	−37	.....	0.16			
−12	1.88	1.67	−25	.....	0.50	−38	.....	0.15	−50	.....	0.05

The excess of the vapor pressure for aqueous vapor over that for ice vapor attains its maximum, 0.214 mm. at the temperature of −15.5° C.

Of course if one wishes to dry the air before cooling it down to the point of liquefaction, one must have some independent method of doing it. If we already have at our disposal a quantity of liquefied air at a temperature of about −200° C. we may utilize this in order to dry any other mass of air. If any vessel containing air is immersed in a bath

of liquid air it is at once cooled so intensely that all the moisture it contains is precipitated as frost on the sides of the vessel. Whatever gaseous moisture is left in the air at this low temperature is entirely inappreciable to our methods of measurement. This air may, therefore, be considered practically dry and may be passed on into other vessels for such experiments as our correspondent has in mind.

The different tensions of ice vapor and water vapor are explained in an important memoir by Prof. M. Thiesen, of Berlin, which we hope to publish for the information of our readers.

TEMPERATURE AND MOISTURE OF SOILS IN RED RIVER VALLEY.

In the October report of the North Dakota Section, Mr. B. H. Bronson publishes the first part of an excellent paper entitled Some Studies in Meteorology, by Prof. E. F. Ladd of the Agricultural College at Fargo, N. Dak. Professor Ladd says that he proposes to publish the results of the continuous observations made at that place since August, 1891. His first study relates to the question of earth temperatures, the depth of the frost, and the quantity of moisture offered to the growing wheat by the thawing of the soil when the rainfall is small and even deficient, upon which matters misconceptions seem to have arisen.

The temperatures of the soil have been determined by means of thermometers at eight different depths, viz, 1, 3, 6, 12, 24, 48, 60, and 84 inches. The instruments were of the pattern designed by Dr. Sturtevant for use at the New York State Experiment Station. In only one winter, that of 1895, did the frost line reach down 5 feet, but each year it passed below 4 feet. The frost was all out of the ground by the 20th of May each year, with a possible exception of 1892–93. It is evident, therefore, that the gradual thawing of the frozen ground, during the summer months can not be a source of moisture to supply the growing crop of wheat. The fact is that the soils of the Red River Valley have the power of holding large quantities of water in storage.

The mean temperature of the soil at different depths, as observed daily at midday for seven years, 1892–1898, is shown in the following table:

Months.	Depth of thermometer, in inches.							
	1.	3.	6.	12.	24.	48.	60.	84.
May	56.6	50.8	46.8	43.9	38.7	34.3	33.7	34.8
June	67.0	61.9	58.8	57.6	51.0	44.0	40.9	38.0
July	74.1	67.9	65.2	63.6	59.3	53.1	49.1	43.7
August	75.6	66.2	64.5	63.5	61.0	56.0	52.9	47.4

THE WEATHER OF THE MONTH.

By ALFRED J. HENRY, Chief of Division of Meteorological Records.

The chief characteristics of the month were high temperatures, relatively heavy rains for the season, light winds, and an absence of severe local or general storms.

Cloudiness was generally greater than usual and the relative humidity of the air was in excess of the normal in the majority of districts.

PRESSURE.

The distribution of monthly mean pressure, shown by Chart IV, differs in several important particulars from the normal distribution for October. The most important departure from normal conditions was the apparent shifting of the area of high pressure usually found over Georgia and South Carolina, to the Middle Atlantic and New England States. It will also be noticed that the monthly means over the last-named region average about 30.20 inches, which value is greater than the local normal October pressures, and also greater by a tenth of an inch than the normal October pressure over the south Atlantic States.

The configuration of the monthly mean isobars follows a summer type more closely than an autumnal one, and is typical of a wet rather than a dry month in the interior valleys and generally to the westward. In a dry October the monthly mean isobars generally run east and west, and the two dominating highs are frequently joined in a ridge of high pressure extending from the Georgia coast to the Plateau region.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

East of the one hundredth meridian the temperature was above normal by amounts ranging from 6° and 8°, daily, in the middle Mississippi Valley, to less than a degree on the Atlantic coast. West of the above-mentioned meridian temperature was below normal by amounts ranging from 4° in eastern Oregon to less than a degree on the Pacific coast.

A period of abnormally high temperature in the central and eastern portions of the country set in about the 10th and continued until about the 25th. During this period unusually high temperatures were recorded in the Mississippi and Missouri valleys, the Lake region, and eastward to New England.

The lines of freezing temperatures did not extend so far south as in the corresponding month of 1898, and in general the minimum temperatures were not so low as in that year, while the maximum temperatures were higher.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	52.8	+ 1.9	+ 2.2	+ 0.2
Middle Atlantic	12	58.3	+ 2.5	+ 0.7	+ 0.1
South Atlantic	10	66.0	+ 1.9	+ 2.0	+ 0.2
Florida Peninsula	7	65.1	+ 1.4	+ 3.5	+ 0.4
East Gulf	7	69.3	+ 2.5	− 1.7	− 0.2
West Gulf	7	70.9	+ 3.8	+ 1.6	+ 0.2
Ohio Valley and Tennessee	12	61.6	+ 4.9	+ 4.3	+ 0.4
Lower Lake	8	56.2	+ 4.9	+ 6.4	+ 0.6
Upper Lake	9	51.9	+ 5.0	− 1.0	− 0.1
North Dakota	7	43.4	+ 0 8	−18.6	− 1.9
Upper Mississippi	11	58.8	+ 6.1	− 1.0	− 0.1
Missouri Valley	10	57.9	+ 5.2	− 4.0	− 0.4
Northern Slope	7	44.4	− 1.8	−25.0	− 2.5
Middle Slope	6	58.8	+ 3.6	− 3.2	− 0.3
Southern Slope	6	65.3	+ 4.1	− 4.7	− 0.5
Southern Plateau	13	57.9	− 1.6	− 6.5	− 0.6
Middle Plateau	9	46.8	− 3.2	−14.3	− 1.4
Northern Plateau	10	45.7	− 3.2	−16.9	− 1.7
North Pacific	9	51.1	− 0.8	−12.4	− 1.2
Middle Pacific	5	58.2	− 1.3	− 4.9	− 0.5
South Pacific	4	61.5	− 1.9	− 5.5	− 0.6

In Canada.—Prof. R. F. Stupart says:

The mean temperature of the month differed little from normal on Vancouver Island and the lower mainland of British Columbia, but on the upper mainland it ranged from 2° to 5° below. In Alberta and the western portions of Assiniboia and Saskatchewan it was about 4° below average, but east of this, near the western boundary of Manitoba, the departure from average became plus, and eastern Manitoba was from 3° to 4° above. All the remaining inhabited portions of Canada were also above, the greatest departures being from 5° to 6° in western and southern Ontario. At nearly all points in the Maritime Provinces the difference from normal was about 2°.

PRECIPITATION.

Precipitation was above normal in the majority of States and districts for the first time in many months. The rains on the Pacific coast were abundant and fairly well distributed, and the general outlook from an agricultural standpoint is very much improved.

There was an abundance of rain for the season in western and southwestern Texas, Oklahoma, western Kansas, northern Wisconsin, and elsewhere.

The most notable deficits occurred over a strip of country extending northeastward from the mouth of the Mississippi River to New England, the continuity of which was broken only in Tennessee, where the rains were seasonable.

SNOWFALL.

The snowfall of the month was confined principally to the upper Missouri Valley and the Rocky Mountain and Plateau regions. The snowfall on the Sierra Nevada at the crossing of the Central Pacific in California ranged from 2 to 3 feet. No snow fell in the Great Valley of California or along the immediate California coast. A very severe snowstorm occurred in western Montana, directly along the eastern foot hills, and extending from Augusta to the international boundary line. The storm was unexpectedly severe, and a number of sheep herders, probably as many as twelve, lost their lives before a place of shelter could be reached. The storm-swept area was about 20 miles wide and upward of 100 miles long. The depth of snowfall over this strip was from 30 to 40 inches, but on either side the amount was very much less.

The depth of snowfall during the month is graphically shown on Chart VIII, and the numerical values are given in Table II.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	2.26	56	−1.8	−3.6
Middle Atlantic	12	2.50	76	−0.8	−2.3
South Atlantic	10	4.90	120	+0.8	−4.6
Florida Peninsula	7	7.91	161	+3.0	0.0
East Gulf	7	1.83	65	−1.0	−10.6
West Gulf	7	3.39	122	+0.6	−7.9
Ohio Valley and Tennessee	12	2.13	81	−0.5	−4.6
Lower Lake	8	2.22	71	−0.9	−6.0
Upper Lake	9	2.45	83	−0.5	−2.8
North Dakota	7	1.38	93	−0.1	−2.0
Upper Mississippi Valley	11	2.28	88	−0.3	+0.1
Missouri Valley	10	1.87	100	0.0	−5.1
Northern Slope	7	1.15	153	+0.4	−0.3
Middle Slope	6	2.83	213	+1.5	+2.9
Southern Slope	6	2.70	159	+1.0	+3.2
Southern Plateau	13	0.50	56	−0.4	−2.5
Middle Plateau	9	2.02	246	+1.2	+1.9
Northern Plateau	10	2.09	192	+1.0	+0.1
North Pacific	9	6.54	127	+1.4	+4.9
Middle Pacific	5	3.92	258	+2.4	+0.3
South Pacific	4	1.97	294	+1.3	−0.5

In Canada.—Professor Stupart says:

The conditions as regards precipitation, were not abnormal to any marked degree in any part of the Dominion. From the limited number of British Columbia reports yet received, it would appear that the average was somewhat exceeded in that Province; and in the Northwest Territories and Manitoba the total, while comparatively small in most localities, was yet in excess of the average, and in the Territories fell largely as snow. At Qu'Appelle, the station reporting the largest amount, it was wholly snow, and 24 inches fell between the 10th and 14th. In the Peninsula of Ontario, that is over the portion of the Province lying west of a line connecting Parry Sound and Belleville, the rainfall was considerably above average, and at some stations near Lakes Ontario and Erie nearly double the average, but in the more eastern and northern parts of the Province there was a deficiency, the rainfall averaging in the neighborhood of 2 inches. In Quebec and New Brunswick there was a very general deficiency, Montreal being the only station reporting an amount slightly greater than the average. In Nova Scotia and Prince Edward Island the fall was for the most part either equal to or in excess of the normal.

HAIL.

The following are the dates on which hail fell in the respective States:

Arizona, 11, 12. Colorado, 2, 3. Georgia, 19. Idaho, 11, Illinois, 14, 19. Indiana, 19, 27. Iowa, 11, 13, 14. Kansas, 14. Louisiana, 21. Michigan, 15, 22. Minnesota, 5, 14, 15, 24. Missouri, 19. Nebraska, 14, 15, 24. New Mexico, 2. North Carolina, 24, 29. Oregon, 10, 11, 12, 19, 24. Tennessee, 19. Texas, 19, 20, 31. Washington, 1, 10, 16, 19. Wisconsin, 14. Wyoming, 10, 14, 16.

SLEET.

The following are the dates on which sleet fell in the respective States:

Colorado, 9, 10, 12, 13, 16, 25, 31. Idaho, 14. Maine, 2. Michigan, 22. Minnesota, 16, 17. Montana, 9, 12, 20, 21, 22. New Hampshire, 20, 21. New Mexico, 31. North Dakota, 11, 12, 15, 16. Ohio, 22. Oregon, 12, 18. South Dakota, 14, 15. Vermont, 2. Wyoming, 14.

HUMIDITY.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	80	+ 2	Missouri Valley	66	+ 1
Middle Atlantic	80	+ 6	Northern Slope	68	+10
South Atlantic	82	+ 5	Middle Slope	58	0
Florida Peninsula	80	0	Southern Slope	62	0
East Gulf	74	+ 2	Southern Plateau	38	−10
West Gulf	72	+ 1	Middle Plateau	48	+ 3
Ohio Valley and Tennessee	70	0	Northern Plateau	67	+ 5
Lower Lake	75	+ 2	North Pacific Coast	82	− 3
Upper Lake	80	+ 3	Middle Pacific Coast	67	− 4
North Dakota	78	+ 8	South Pacific Coast	70	+ 1
Upper Mississippi	70	0			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Block Island, R. I.	6	53	ne.	Havana, Cuba	24	51	ne.
Do.	31	57	ne.	Mount Tamalpais, Cal.	9	54	nw.
Cape Henry, Va.	6	58	nw.	Do.	10	71	nw.
Do.	30	66	ne.	Do.	18	50	nw.
Do.	31	72	ne.	Do.	19	61	se.
Charleston, S. C	30	58	nw.	Do.	23	52	nw.
Chicago, Ill.	10	53	s.	New York, N. Y.	31	52	ne.
Fort Canby, Wash.	18	76	se.	Norfolk, Va.	31	50	ne.
Do.	19	78	se.				

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.4	+0.9	Missouri Valley	4.0	+0.1
Middle Atlantic	5.0	+0.2	Northern Slope	5.5	+1.3
South Atlantic	5.1	+1.1	Middle Slope	3.6	+0.5
Florida Peninsula	5.5	+0.8	Southern Slope	2.9	+0.1
East Gulf	4.4	+0.8	Southern Plateau	2.5	+0.5
West Gulf	4.3	+0.7	Middle Plateau	4.9	+1.7
Ohio Valley and Tennessee	4.5	0.0	Northern Plateau	6.3	+1.2
Lower Lake	5.1	−0.7	North Pacific Coast	6.7	+0.8
Upper Lake	6.0	−0.1	Middle Pacific Coast	4.2	+1.0
North Dakota	6.0	+0.9	South Pacific Coast	3.5	+0.5
Upper Mississippi	4.2	−0.2			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table VII, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 732 thunderstorms were received during the current month as against 619 in 1898 and 2,203 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 19th, 87; 15th, 80; 14th, 69; 24th, 65.

Reports were most numerous from: Minnesota, 71; Michigan, 68; Iowa, 60; Wisconsin, 56; Nebraska, 55.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, 14th to 22d.

The greatest number of reports were received for the following dates: 5th, 18; 6th, 22, and 23d, 3.

Reports were most numerous from: Montana, 8; North Dakota, 5; Minnesota, 4.

In Canada.—Auroras were reported as follows: Yarmouth, 5th, 22d; Father Point, 14th, 23d, 26th; Quebec, 5th, 14th, 15th; Toronto, 5th; White River, 26th; Minnedosa, 25th; Qu'Appelle, 5th, 6th, 7th; Swift Current, 30th; Prince Albert, 4th, 5th, 6th, 30th.

Thunderstorms were reported as follows: Father Point, 24th; Toronto, 14th, 23d; White River, 24th; Ottawa, 14th; Port Stanley, 22d, 23d; Saugeen, 14th, 23d; Parry Sound, 14th, 23d; Port Arthur, 13th; Calgary, 6th.

DESCRIPTION OF TABLES AND CHARTS.

By ALFRED J. HENRY, Chief of Division of Meteorological Records.

For description of tables and charts see page 424 of REVIEW for September, 1899.

TABLE I.—*Climatological data for Weather Bureau Stations, October*, 1899.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
New England.							52.8	+ 1.9									83	2.26	— 1.6									6.4	
Eastport	76	69	74	30.12	30.21	+ .20	48.4	+ 1.6	75	26	54	28	21	42	24	44	40	77	1.92	— 2.2	10	6,995	n.	28	n.	21	6	13	12	6.5	0.2
Portland, Me	103	81	89	30.08	30.19	+ .15	50.6	+ 1.5	74	26	58	30	22	44	25	46	42	76	1.46	— 2.4	10	4,562	nw.	21	ne.	31	7	11	13	6.1	T.
Northfield	872	15	65	29.28	30.23	+ .19	47.7	+ 4.4	78	14	57	20	22	38	38	43	40	83	2.49	+ 0.2	11	5,641	s.	29	nw.	21	3	12	16	7.1	T.
Boston	135	115	181	30.09	30.22	+ .17	54.5	+ 2.6	77	14	62	34	22	47	29	49	46	78	2.40	— 1.9	9	6,807	nw.	32	ne.	31	9	6	16	6.3	T.
Nantucket	14	43	54	30.19	30.20	+ .13	54.5	+ 1.9	68	27	59	38	21	50	18	51	48	83	3.06	— 0.9	9	8,255	w.	37	n.	6	5	6	20	7.3	T.
Woods Hole	22	11	57	30.19	30.21	+ .17	54.9	+ 1.5	70	19	60	37	21	50	19	51	49	85	1.91	— 2.1	8	9,659	nw.	47	n.	6	8	8	15	6.4	
Vineyard Haven	.....	30	55	.....	.....	.....	55.5	+ 1.8	72	18	61	36	21	50	18	.....	.....	.....	3.11	— 1.5	7	6,250	n.	36	ne.	31	4	12	15	7.1	
Block Island	27	11	48	30.19	30.22	+ .12	54.6	+ 1.0	68	19	59	37	22	50	16	51	48	80	2.23	— 2.2	7	11,602	w.	57	ne.	31	10	6	15	6.0	
Narragansett	.....	10	.....	.....	.....	.....	52.9	+ 0.6	72	19	60	27	22	46	28	.....	.....	.....	2.23	— 2.5	5	.....	w.	.....	.....	...	15	2	14	.....	
New Haven	107	118	140	30.10	30.22	+ .15	54.2	+ 1.8	74	18	62	29	3	46	33	50	47	82	1.78	— 2.3	6	5,937	ne.	30	ne.	31	12	10	9	4.8	
Mid. Atlan. States.							53.3	+ 2.5										83	2.50	— 0.8								5.0	
Albany	97	84	113	30.12	30.24	+ .18	53.4	+ 2.8	81	12	62	28	22	45	29	48	44	77	0.85	— 2.4	8	4,637	s.	24	s.	16	6	11	14	6.7	T.
Binghamton	875	79	90	.....	.....	.....	54.0	+ 5.9	82	15	65	21	22	43	33	.....	.....	.....	1.12	— 1.8	8	3,551	w.	22	n.	20	12	4	15	5.8	
New York	314	313	346	29.88	30.21	+ .13	58.2	+ 3.2	79	18	65	36	22	52	22	53	50	80	2.05	— 1.5	6	7,971	nw.	52	ne.	31	12	9	9	4.8	
Harrisburg	377	94	104	.....	.....	.....	56.0	+ 3.5	78	13	64	31	22	48	26	.....	..	..	0.78	— 2.3	7	3,445	ne.	30	ne.	31	9	8	14	5.9	
Philadelphia	117	168	184	30.10	30.22	+ .12	58.6	+ 2.8	80	13	66	34	22	51	22	53	49	76	1.98	— 0.9	7	6,313	sw.	36	ne.	31	13	6	12	5.0	
Atlantic City	52	68	76	30.15	30.20	+ .13	57.6	+ 1.3	79	18	63	33	22	52	18	55	53	85	2.55	— 0.7	4	7,345	sw.	44	ne.	6	10	16	5	4.8	
Cape May	17	47	51	30.20	30.22	.....	58.6	— 0.3	75	18	64	34	22	53	23	55	.....	.....	3.73	+ 0.4	6	5,367	ne.	46	ne.	31	15	7	9	4.6	
Baltimore	123	68	82	30.06	30.19	+ .10	58.7	+ 1.8	78	12	67	34	22	51	26	53	49	75	2.09	— 0.8	6	3,415	e.	26	ne.	31	11	9	11	5.1	
Washington	112	59	76	30.09	30.21	+ .11	58.5	+ 2.3	80	27	68	32	22	48	30	53	50	83	2.80	— 0.3	7	3,836	s.	28	nw.	31	18	4	9	4.1	
Cape Henry	.....	5	34	.....	.....	.....	63.1	+ 1.3	80	8	69	44	23	57	22	.....	.....	...	4.71	+ 0.9	7	9,906	ne.	72	ne.	31	19	3	9	4.5	
Lynchburg	685	83	88	29.45	30.19	+ .10	59.1	+ 2.0	80	13	70	32	2	48	38	53	50	84	3.87	+ 0.6	6	2,045	e.	28	ne.	31	17	5	9	4.0	
Norfolk	92	102	111	30.08	30.18	+ .09	63.5	+ 2.9	80	8	70	46	23	57	26	58	56	84	3.47	— 0.4	8	6,598	ne.	50	ne.	31	16	6	9	4.8	
Richmond	144	98	105	.....	.....	.....	61.0	.....	81	27	70	37	1	52	31	.....	.....	.....	4.03	.....	7	4,157	n.	36	n.	31	10	11	10	5.5	
S. Atlantic States.							66.0	+ 1.9										82	4.90	+ 0.8								5.1	
Charlotte	773	68	76	29.33	30.15	+ .07	61.4	+ 1.1	82	19	71	36	2	52	30	54	50	74	4.01	+ 0.3	7	4,856	ne.	35	ne.	31	14	6	11	4.9	
Hatteras	11	17	36	30.13	30.14	+ .08	67.2	+ 2.7	79	19	72	52	22	63	13	63	61	84	9.38	+ 3.2	13	9,673	n.	46	ne.	30	14	9	8	4.5	
Kittyhawk	9	12	30	30.12	30.13	+ .09	65.4	+ 1.8	78	8	69	52	22	61	15	63	61	87	6.58	+ 2.9	10	12,110	ne.	.....	.....	...	14	7	10	4.6	
Raleigh	375	93	101	29.76	30.16	+ .08	62.1	+ 4.1	83	18	71	38	22	53	31	56	54	84	5.12	+ 0.2	10	4,619	ne.	41	n.	31	16	8	7	4.3	
Wilmington	78	82	90	30.04	30.12	+ .05	65.3	+ 1.8	88	19	74	44	22	57	25	60	58	84	2.69	— 1.2	8	6,386	ne.	43	se.	31	15	7	9	4.8	
Charleston	48	14	92	30.07	30.12	+ .05	68.8	+ 2.1	83	20	75	50	22	63	19	62	60	79	3.48	— 0.7	10	9,892	ne.	58	nw.	30	9	14	8	5.3	
Columbia	.....	5	.....	.....	.....	.....	64.2	+ 0.1	88	19	74	42	2	54	35	.....	.....	.....	6.95	+ 3.6	7	.....	ne.	.....	.....	...	11	9	11	5.5	
Augusta	180	89	103	29.92	30.11	+ .05	65.4	+ 1.7	88	19	74	46	2	56	30	58	55	75	4.46	+ 2.0	7	4,819	ne.	30	n.	30	14	7	10	4.8	
Savannah	65	79	89	30.02	30.08	.00	68.2	+ 1.8	86	18	76	51	1	61	22	62	60	82	3.63	0.0	10	6,561	ne.	30	n.	30	9	12	10	5.7	
Jacksonville	43	69	84	29.99	30.04	+ .01	71.8	+ 2.1	87	19	78	54	30	65	24	66	65	86	2.73	— 2.5	17	6,642	ne.	31	w.	31	3	18	10	6.6	
Florida Peninsula.							76.4	+ 0.7										83	7.91	+ 2.3								5.5	
Jupiter	38	13	30	29.92	29.95	.00	76.8	+ 1.4	89	5	82	62	31	72	16	72	69	79	16.66	+ 7.4	15	10,984	ne.	38	ne.	22	6	19	6	5.7	
Key West	22	43	50	29.91	29.93	— .01	78.2	— 0.3	86	5	81	70	26	75	11	73	72	81	4.66	— 0.6	10	11,416	ne.	40	nw.	29	12	13	6	5.1	
Tampa	36	60	67	29.94	29.98	— .03	74.2	+ 1.1	86	19	82	59	31	66	22	68	66	81	2.42	0.0	7	5,740	ne.	25	ne.	21	7	19	5	5.6	
East Gulf States.							69.3	+ 2.5										74	1.83	— 1.0								4.4	
Atlanta	1,174	139	156	28.90	30.13	+ .02	63.6	+ 1.4	84	19	72	43	2	55	25	56	51	71	3.71	+ 1.4	9	7,519	e.	44	nw.	31	11	12	8	4.5	
Macon	370	.....	.....	.....	.....	.....	65.4	.....	86	19	74	46	2	56	28	.....	.....	.....	5.20	. .....	9	5,455	ne.	32	nw.	19	8	17	6	4.9	
Pensacola	56	78	90	.....	.....	.....	70.8	+ 1.6	88	20	78	50	30	64	22	.....	.....	..	2.05	— 1.3	3	7,566	ne.	30	ne.	4	16	8	7	4.6	
Mobile	57	88	96	30.00	30.06	+ .02	69.9	+ 2.5	87	21	78	50	30	62	26	63	60	80	1.31	— 2.1	7	5,261	n.	22	n.	29	24	2	5	3.2	
Montgomery	221	100	112	29.85	30.09	+ .02	68.0	+ 2.8	88	19	78	45	1	58	26	59	55	78	3.77	+ 1.4	6	4,635	ne.	24	ne.	2	14	9	8	4.3	
Meridian	375	84	94	.....	.....	.....	67.2	+ 5.0	87	12	78	42	1	56	38	.....	.....	.....	0.52	— 0.9	4	4,194	ne.	19	n.	29	12	13	6	4.5	
Vicksburg	247	65	73	29.78	30.04	— .04	69.8	+ 4.5	89	14	80	42	30	59	27	60	56	69	0.91	— 1.7	5	4,815	se.	19	e.	4	14	13	4	3.9	
New Orleans	54	112	120	29.99	30.05	+ .03	71.4	+ 1.6	86	20	79	55	30	64	20	64	61	77	0.89	— 2.3	8	6,639	se.	32	ne.	3	8	11	12	5.7	
Port Eads	.....	27	...	.....	.....	.....	73.8	+ 0.6	88	6	80	56	31	68	27	.....	.....	.....	1.50	— 2.4	7	.....	e.	.....	.....	...	8	9	14	.....	
West Gulf States.							70.9	+ 3.3										72	3.39	+ 0.6								4.3	
Shreveport	249	77	84	29.79	30.05	— .01	69.9	+ 4.6	90	12	81	40	30	59	33	60	54	66	1.53	— 1.6	5	4,778	se.	27	ne.	11	19	8	4	3.2	
Fort Smith	457	74	82	29.55	30.03	— .02	67.1	+ 6.0	92	14	79	38	29	55	36	57	51	67	3.34	+ 0.5	5	5,216	e.	25	se.	9	16	9	6	4.4	
Little Rock	357	93	100	29.69	30.08	+ .01	66.6	+ 4.3	88	13	77	40	31	56	30	58	53	70	1.18	— 1.3	6	4,546	se.	23	nw.	28	17	9	5	3.8	
Corpus Christi	20	42	50	29.97	29.99	— .04	74.8	+ 2.3	85	11	79	55	29	70	19	70	67	80	7.34	+ 5.1	10	8,324	se.	37	ne.	20	12	11	8	4.6	
Fort Worth	670	106	114	.....	.....	.....	69.4	.....	92	11	81	43	29	58	37	.....	.....	.....	1.49	.....	6	6,762	se.	20	nw.	27	18	10	3	3.9	
Galveston	54	85	96	29.95	30.00	— .03	74.6	+ 2.3	85	21	79	56	30	71	14	68	66	79	1.86	— 2.4	7	6,957	se.	26	nw.	28	13	12	6	4.6	
Palestine	510	54	61	29.48	30.03	— .02	70.2	+ 3.7	90	12	81	40	30	59	35	61	57	73	7.18	+ 4.0	6	4,471	n.	26	s.	10	12	9	10	5.0	
San Antonio	704	95	104	29.26	29.99	— .04	72.8	+ 3.1	92	12	83	46	30	63	32	63	58	67	1.31	— 0.4	4	6,248	se.	27	nw.	28	12	9	10	4.8	
Ohio Val. & Tenn.							61.6	+ 4.9										73	2.13	— 0.5								4.6	
Chattanooga	762	106	112	29.34	30.15	+ .05	63.4	+ 2.9	82	18	74	42	2	53	32	55	51	73	2.92	+ 0.2	7	3,797	ne.	36	nw.	19	14	10	7	4.5	
Knoxville	1,004	10	88	29.09	30.15	+ .03	61.6	+ 4.0	81	15	73	37	1	50	33	54	50	76	2.53	— 0.3	10	3,941	ne.	30	sw.	28	15	7	9	4.3	
Memphis	399	140	154	29.67	30.10	— .02	66.6	+ 5.0	87	14	76	41	1	57	32	57	50	63	1.78	— 1.0	5	4,064	se.	26	ne.	11	17	8	6	3.8	
Nashville	545	128	134	29.56	30.14	+ .06	63.6	+ 4.0	85	12	75	38	1	52	35	55	50	68	1.83	— 0.6	6	4,171	s.	25	se.	15	16	7	8	3.9	
Lexington	990	75	102	.....	.....	.....	60.6	+ 5.3	84	14	70	37	1	51	38	.....	.....	.....	2.09	— 0.1	7	6,766	se.	35	nw.	28	12	6	13	4.9	
Louisville	525	114	136	29.58	30.15	+ .06	63.0	+ 5.3	90	14	74	38	1	52	36	53	47	67	2.41	— 0.4	6	5,397	se.	32	w.	19	16	5	10	4.5	
Evansville	434	72	82	.....	.....	.....	63.4	.....	90	14	74	37	1	53	35	.....	.....	.....	2.20	.....	3	4,412	se.	20	s.	16	18	6	7	3.5	
Indianapolis	823	154	164	29.27	30.14	+ .06	60.0	+ 5.6	86	14	70	33	1	50	32	51	45	65	2.51	— 0.3	9	6,826	s.	36	s.	10	13	9	9	4.8	
Cincinnati	628	152	157	29.49	30.16	+ .08	60.6	+ 4.2	86	14	71	36	1	50	34	52	46	66	1.64	— 0.8	7	4,338	se.	23	sw.	28	19	5	7	4.0	
Columbus	824	87	100	29.29	30.16	+ .09	59.2	+ 5.5	86	15	70	30	1	48	35	51	46	70	2.23	— 0.4	7	4,783	s.	24	sw.	28	16	4	11	4.8	
Pittsburg	842	116	123	29.28	30.18	+ .10	59.4	+ 4.7	86	15	70	30	1	49	33	51	46	70	2.10	— 0.3	7	3,271	sw.	22	nw.	17	14	8	9	4.6	
Parkersburg	638	77	84	29.52	30.21	+ .15	59.2	+ 6.9	84	14	71	30	1	47	36	50	47	77	1.44	— 1.7	8	2,736	se.	32	nw.	17	13	6	12	5.3	
Elkins	1,940	41	51	.....	.....	.....	54.4	.....	82	15	70	22	1	39	45	.....	.....	...	1.15	.....	5	2,156	n.	21	ne.	31	9	11	11	5.6	
Lower Lake Region.							56.2	+ 4.9										75	2.22	— 0.9								5.1	
Buffalo	768	178	206	29.35	30.18	+ .14	55.8	+ 5.5	80	13	62	33	21	49	25	50	47	77	2.99	— 0.7	10	8,199	sw.	32	s.	17	9	10	12	6.3	
Oswego	335	76	87	29.83	30.20	+ .14	53.7	+ 3.7	83	14	61	28	22	46	29	48	44	75	3.10	— 0.2	12	6,464	se.	30	s.	17	8	10	13	5.7	T.
Rochester	523	81	90	29.63	30.20	+ .15	54.6	+ 5.0	83	14	63	29	3	46	29	48	44	74	2.07	— 0.8	12	4,249	sw.	30	sw.	26	10	10	11	5.5	T.
Erie	714	92	102	29.42	30.19	— .14	57.2	+ 5.0	81	14	64	34	3	50	27	51	47	75	2.04	— 2.1	11	7,018	s.	27	s.	17	10	14	7	5.2	
Cleveland	762	190	201	29.35	30.16	+ .09	57.4	+ 5.2	84	14	65	34	2	50	29	51	47	75	1.81	— 1.1	7	9,222	se.	35	n.	20	12	13	6	4.6	
Sandusky	629	62	74	29.49	30.16	+ .09	58.4	+ 5.2	87	14	66	34	1	50	33	51	46	72	1.90	— 0.9	10	4,962	sw.	18	n.	29	12	11	8	4.9	
Toledo	628	123	127	29.49	30.17	+ .12	56.9	+ 4.8	84	14	66	29	1	48	33	50	45	73	1.50	— 0.9	8	6,093	s.	27	sw.	10	16	7	8	4.5	
Detroit	730	160	166	29.37	30.16	+ .11	56.0	+ 5.0	79	15	64	32	1	48	25	49	46	76	2.35	— 0.2	6	6,000	ne.	28	s.	16	15	8	8	4.4	
Upper Lake Region.							51.9	+ 5.0										80	2.45	— 0.5								6.0	
Alpena	609	61	65	29.48	30.15	+ .12	50.1	+ 4.9	79	24	58	31	8	42	28	46	44	83	2.78	— 1.0	11	6,340	nw.	29	w.	24	9	11	11	5.5	
Escanaba	612	43	57	29.44	30.10	+ .09	48.3	+ 3.6	66	24	56	28	1	41	28	45	42	83	1.17	— 2.1	12	6,746	s.	26	n.	31	5	8	18	7.3	
Grand Haven	628	55	64	29.44	30.12	+ .10	54.2	+ 4.6	89	15	63	28	1	46	31	49	46	81	2.57	— 0.6	8	6,704	se.	28	s.	16	15	8	8	4.5	
Marquette	734	67	95	29.26	30.06	+ .06	49.7	+ 4.6	78	23	57	31	1	42	32	45	42	83	3.46	+ 0.2	13	7,794	se.	38	se.	21	8	7	16	6.6	
Port Huron	639	70	108	29.49	30.18	+ .14	54.4	+ 5.5	79	15	63	32	2	46	29	49	45	80	4.15	+ 1.4	14	7,174	s.	27	s.	16	17	4	10	5.0	
Sault Ste. Marie	614	40	60	29.46	30.13	+ .12	47.7	+ 5.0	73	16	55	29	21	40	26	44	42	90	2.22	— 1.3	12	5,956	se.	29	sw.	16	9	4	18	6.8	0.1
Chicago	824	241	274	29.24	30.12	+ .08	58.0	+ 6.0	84	15	65	36	29	51	27	52	48	74	2.09	— 0.8	10	13,122	s.	53	s.	10	10	11	10	5.3	
Milwaukee	681	124	142	29.38	30.11	+ .08	56.4	+ 7.2	84	13	64	35	29	48	31	50	46	75	1.21	— 1.1	12	8,610	sw.	32	se.	1	7	7	17	6.5	
Green Bay	617	49	57	29.43	30.10	+ .06	53.0	+ 6.1	81	23	63	28	20	43	32	46	43	78	1.35	— 1.1	9	5,833	s.	36	n.	31	7	9	15	6.5	
Duluth	702	95	106	29.28	30.04	+ .04	47.6	+ 2.7	67	5	54	33	19	42	25	43	39	78	3.54	+ 1.0	10	7,182	ne.	38	ne.	15	8	9	14	6.0	
North Dakota.							45.5	+ 0.1										78	1.08	— 0.3								6.0	
Moorhead	935	54	60	29.00	30.04	+ .04	45.7	+ 2.6	70	6	55	26	4	37	38	40	37	80	1.48	— 0.4	5	6,886	se.	42	se.	1	8	6	17	6.9	
Bismarck	1,674	16	29	28.23	30.04	+ .04	43.4	— 0.4	86	6	54	24	31	33	44	37	33	75	0.55	— 0.5	4	6,203	nw.	29	nw.	17	10	8	13	5.5	0.1
Williston	1,872	15	31	28.00	30.03	+ .02	41.4	— 1.8	85	6	52	17	18	31	49	36	32	78	1.06	+ 0.1	9	6,242	n.	36	nw.	16	12	8	11	5.6	7.9

TABLE I.—*Climatological data for Weather Bureau Stations, October, 1899*—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Elevation of instruments: Thermometers above ground.	Elevation of instruments: Anemometer above ground.	Pressure, in inches: Mean actual, 8 a. m. and 8 p. m. +2.	Pressure, in inches: Mean reduced.	Pressure, in inches: Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. and min. +2.	Temperature: Departure from normal.	Temperature: Maximum.	Temperature: Date.	Temperature: Mean maximum.	Temperature: Minimum.	Temperature: Date.	Temperature: Mean minimum.	Temperature: Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Precipitation: Departure from normal.	Precipitation: Days with .01, or more.	Wind: Total movement, miles.	Wind: Prevailing direction.	Wind: Maximum velocity: Miles per hour.	Wind: Maximum velocity: Direction.	Wind: Maximum velocity: Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
Upper Miss. Valley.							**58.8**	**+ 0.1**										**70**	**2.28**	**− 0.3**									**4.2**	
Minneapolis	.....	99	208	.....	.....	.....	52.8	+ 4.9	82	15	63	33	29	43	35	...	...	....	3.17	+ 1.4	10	7,531	s.	39	se.	1	7	8	16	....	0.1
St. Paul	837	114	124	29.11	30.02	+ .01	52.8	+ 5.7	81	23	63	34	29	43	34	45	40	71	3.09	+ 1.2	10	5,452	se.	27	se.	15	8	10	13	5.8	0.1
La Crosse	720	70	78	.....	.....	.....	54.7	+ 5.2	84	23	66	32	29	44	33	...	...	....	1.11	1.1	8	5,432	se.	30	nw.	31	8	15	8	5.4	
Davenport	606	71	79	29.42	30.07	+ .01	59.2	+ 7.1	86	13	69	34	29	49	31	51	46	72	1.46	1.2	9	5,456	se.	24	sw.	13	17	5	9	4.2	
Des Moines	867	84	88	29.13	30.06	+ .01	59.2	+ 7.0	91	12	72	27	29	47	40	49	42	64	0.59	2.4	5	6,595	sw.	38	sw.	23	17	8	6	4.0	
Dubuque	698	101	109	29.32	30.08	+ .04	56.8	+ 6.2	85	23	68	33	29	46	34	49	43	71	1.68	1.1	8	5,650	se.	24	se.	15	12	10	9	4.7	
Keokuk	614	64	78	29.42	30.08	+ .02	61.0	+ 6.9	90	13	71	34	29	51	33	52	47	70	2.06	0.7	9	5,580	se.	24	se.	1	20	6	5	3.1	
Cairo	359	87	93	29.72	30.11	+ .04	63.8	+ 5.1	87	13	73	42	30	54	30	56	52	76	3.42	+ 0.7	5	4,934	se.	27	n.	17	17	8	6	3.6	
Springfield, Ill.	644	82	92	29.41	30.09	+ .02	60.4	+ 5.4	88	13	71	35	29	50	35	52	47	71	4.08	+ 1.4	9	6,547	s.	24	s.	10	13	10	8	4.7	
Hannibal	534	75	107	.....	.....	.....	61.8	+ 6.8	91	13	73	32	31	51	37	...	...	....	1.57	1.1	7	6,624	s.	33	s.	23	22	3	6	3.0	
St. Louis	567	111	210	29.48	30.09	+ .03	64.4	+ 6.9	90	13	74	41	29	55	35	55	49	66	2.89	0.0	8	6,429	s.	28	sw.	16	15	11	5	3.6	
Missouri Valley.							**57.9**	**+ 5.2**										**66**	**1.87**	**0.0**									**4.0**	
Columbia	783	4	84	.....	.....	.....	63.4	+ 7.3	95	13	77	29	29	50	41	...	...	....	2.73	+ 1.3	6	5,665	s.	26	s.	15	20	6	5	3.1	
Kansas City	963	78	95	29.03	30.05	.00	64.2	+ 8.5	91	13	75	40	29	53	36	53	45	58	0.80	− 2.6	3	6,965	se.	30	sw.	9	20	4	7	2.9	
Springfield, Mo.	1,324	100	103	28.66	30.05	− .01	63.8	+ 7.8	88	12	74	36	29	54	30	56	51	73	5.41	+ 2.5	7	7,996	se.	28	sw.	9	23	4	4	2.8	
Topeka	.....	81	...	.....	.....	.....	63.0	+ 7.0	93	12	75	34	17	51	36	...	...	....	0.76	− 1.1	4	.....	s.	....	.....	...	16	9	6	3.3	
Lincoln	1,199	74	84	28.72	29.99	− .06	59.5	+ 5.4	92	12	72	34	19	47	42	49	41	62	2.58	+ 0.7	5	8,508	s.	38	s.	23	15	10	6	4.1	
Omaha	1,105	115	123	28.82	29.99	− .05	59 6	+ 6.7	92	12	71	35	28	48	40	50	44	66	2.26	0.2	6	6,792	se.	36	n.	2	14	12	5	4.5	
Sioux City	1,139	96	164	.....	.....	.....	54.2	+ 3.2	89	12	66	30	28	42	46	...	...	....	1.33	0.4	7	9,276	s.	49	s.	15	17	5	9	4.0	
Pierre	1,572	50	62	28.32	30.01	− .02	48.6	− 0.8	92	1	60	24	18	37	47	40	32	63	0.75	+ 0.1	7	6,230	n.	44	nw.	1	10	7	14	5.7	
Huron	1,306	56	67	28.60	30.02	− .01	48.6	+ 2.1	82	1	61	22	28	36	46	41	36	73	1.43	+ 0.2	8	7,516	nw.	38	se.	20	10	11	10	5.0	
Yankton	1,234	52	58	.....	.....	.....	54.1	+ 4.4	87	1	67	28	28	41	41	....	....	....	0.66	− 0.8	7	5,746	w.	37	s.	15	13	9	9	5.0	
Northern Slope.							**44.4**	**− 1.8**										**63**	**1.15**	**+ 0.4**									**5.5**	
Havre	2,494	46	47	27.33	29.99	− .03	40.9	− 3.1	85	5	52	2	14	30	52	36	31	75	0.86	+ 0.2	8	7,206	sw.	36	w.	6	11	11	9	5.1	3.9
Miles City	2,371	42	50	27.47	30.00	− .04	44.4	− 1.7	84	6	55	24	26	34	46	39	37	83	1.06	+ 0.2	11	4,201	w.	30	w.	17	12	5	14	4.6	4.0
Helena	4,108	88	93	25.85	30.11	+ .05	41.4	− 3.8	75	5	49	12	14	33	35	35	27	63	1.45	+ 0.6	11	5,097	sw.	42	sw.	8	9	4	18	6.3	11.2
Kalispell	2,964	45	51	26.92	30.05	.....	41.6	.....	64	6	50	19	14	33	34	37	33	78	1.13	.....	12	4,031	nw.	24	nw	8	7	14	10	6.0	0.9
Rapid City	3,251	46	50	26.59	29.98	− .05	47.9	− 1.1	86	1	58	26	26	38	39	40	32	63	1.58	+ 0.9	5	5,578	w.	36	nw.	1	9	9	13	5.7	0.4
Cheyenne	6,084	58	60	24.01	30.08	+ .03	43.4	− 1.5	80	1	56	19	16	31	41	34	24	57	1.27	+ 0.6	9	7,229	w.	42	w.	17	10	6	15	6.1	8.0
Lander	5,372	28	36	24.62	30.07	.00	41.5	− 2.6	77	6	55	18	26	28	51	34	25	63	1.57	+ 0.7	8	3,092	sw.	48	sw.	1	8	16	7	5.8	9.8
North Platte	2,836	43	52	27.06	30.02	− .02	51.0	+ 1.2	94	1	66	23	28	36	50	41	35	65	0.28	− 0.7	5	5,460	nw.	34	s.	1	12	12	7	4.7	
Middle Slope.							**53.8**	**+ 3.6**										**58**	**2.83**	**+ 1.5**									**3.6**	
Denver	5,290	79	151	24.72	30.05	+ .01	49.4	+ 1.1	87	1	62	28	18	37	40	39	27	51	1.01	+ 0.1	6	5,540	s.	37	ne.	2	18	6	7	4.4	0.8
Pueblo	4,682	74	81	25.28	29.99	− .02	52.5	+ 0.3	88	1	67	24	16	38	49	40	26	43	0.80	− 0.1	3	5,300	se.	42	ne.	31	14	12	5	4.4	
Concordia	1,398	42	47	28.52	30.00	− .04	61.5	+ 7.0	93	12	74	37	28	49	40	50	44	64	5.41	+ 3.9	6	6,414	s.	36	s.	15	20	4	7	3.8	
Dodge	2,504	44	52	27.38	29.98	− .03	59.2	+ 4.1	89	11	74	30	16	45	48	42	42	65	3.94	+ 2.7	6	9,191	s.	41	s.	1	22	3	6	3.4	
Wichita	1,351	78	85	28.58	30.00	− .04	64.4	+ 6.8	89	12	76	39	28	53	35	53	46	62	1.55	− 0.2	4	7,600	s.	36	sw.	9	23	3	5	2.5	
Oklahoma	1,218	54	62	28.72	30.00	− .03	65.9	+ 4.4	90	12	77	39	17	55	39	55	49	65	4.25	+ 2.5	5	8,173	s.	34	s.	15	21	4	6	3.2	
Southern Slope.							**63.6**	**+ 5.2**										**62**	**2.02**	**+ 0.2**									**2.9**	
Abilene	1,749	45	54	28.20	30.01	− .04	68.8	+ 4.3	92	13	80	44	6	58	35	57	49	61	2.90	+ 0.6	3	7,728	se.	36	se.	15	18	10	3	2.9	
Amarillo	3,691	54	61	26.25	30.00	− .03	58.4	+ 2.2	82	11	70	34	17	47	40	49	42	63	1.15	− 0.2	4	12,191	s.	47	s.	23	21	5	5	2.9	
Southern Plateau.							**61.8**	**− 1.1**										**38**	**0.18**	**− 0.4**									**2.5**	
El Paso	3,767	10	110	26.17	29.97	.00	63.1	+ 0.1	89	21	77	37	27	49	44	47	30	36	0.01	− 0.9	1	7,612	nw.	41	w.	10	18	11	2	2.9	
Santa Fe	6,998	47	50	23.28	30.01	.00	50.4	+ 0.6	74	1	60	24	27	40	28	38	23	42	0.27	− 0.7	5	5,124	se.	37	sw.	14	20	6	5	3.0	T.
Flagstaff †	6,885	12	25	23.33	30.07	.....	44.0	.....	72	1	57	18	25	31	41	37	...	....	4.89	.....	6	.....	sw.	....	.....	...	8	9	14	....	T.
Phenix	1,076	47	57	28.75	29.87	− .02	68.9	− 0.9	96	1	82	40	16	56	37	53	39	40	0.30	− 0.3	5	3,235	e.	25	s.	11	21	3	7	3.1	
Yuma	139	16	50	29.71	29.85	− .03	71.0	− 2.0	98	1	85	43	31	57	38	56	42	48	0.02	− 0.3	1	5,579	nw.	29	nw.	30	23	6	2	1.7	
Independence	3,907	10	58	25.95	29.91	− .03	55.4	− 3.3	84	1	68	29	12	43	32	41	20	29	0 30	0.0	4	6,565	nw.	36	nw.	11	22	8	1	2.0	
Middle Plateau.							**46.7**	**− 3.5**										**48**	**1.35**	**+ 0.5**									**4.9**	
Carson City	4,730	82	92	25.25	30.04	+ .04	46.6	− 3.6	78	6	60	22	15	34	45	38	27	52	0.63	+ 0.2	5	4,368	sw.	38	sw.	19	11	12	8	4.8	6.3
Winnemucca	4,340	59	70	25.66	30.06	+ .01	44.4	− 3.8	78	6	57	15	15	32	51	36	21	51	0.56	+ 0.1	5	6,723	sw.	48	s.	19	10	8	13	5.8	10.0
Cedar City	5,850	36	47	24.24	30.04	.....	48.0	.....	75	1	59	23	25	38	33	37	22	41	1.03	.....	6	4,978	se.	32	sw.	10	17	8	6	4.0	0.3
Salt Lake City	4,360	105	110	25.62	30.05	− .02	49.2	− 3.1	73	6	58	30	25	40	30	40	28	50	2.85	+ 1.3	12	4,270	se.	30	nw.	1	10	12	9	4.8	5.7
Grand Junction	4,608	43	50	25.36	30.02	.....	51.2	.....	86	1	63	28	26	40	36	32	27	47	2.67	.....	6	3,443	nw.	33	sw.	11	12	9	10	4.9	0.2
Northern Plateau.							**46.9**	**− 2.0**										**67**	**2.55**	**+ 1.3**									**6.3**	
Baker City	3,470	49	55	26.43	30.06	− .02	43.2	− 4.9	76	5	52	18	11	34	36	37	30	65	1.75	+ 0.6	10	4,045	s.	27	sw.	19	8	9	14	6.3	4.6
Boise	2,736	61	68	27.17	30.05	− .06	48.0	− 1.4	80	5	59	28	13	37	41	41	34	64	3.03	+ 2.0	9	3,071	w.	24	e.	19	10	7	14	5.7	T.
Pocatello	4,482	48	56	25.49	30.07	− .01	44.9	− 0.1	77	5	56	23	10	34	42	38	31	67	2.65	+ 1.6	12	7,957	s.	46	sw.	20	6	8	17	6.8	4.5
Spokane	1,943	99	107	27.96	30.03	− .03	46.7	− 1.3	79	5	56	21	14	38	39	41	34	66	2.23	+ 0.6	9	4,121	ne.	29	sw.	20	4	8	19	7.5	T.
Walla Walla	1,018	65	73	28.94	30.03	− .05	51.6	− 2.4	83	5	60	30	14	43	34	47	43	75	3.07	+ 1.5	11	3,526	s.	20	sw.	8	7	20	4	5.0	T.
N. Pac. Coast Reg.							**51.1**	**− 0.8**										**82**	**6.54**	**+ 1.4**									**6.7**	
Fort Canby	179	10	34	29.82	30.02	− .01	52.2	− 1.2	77	4	56	41	14	48	22	49	47	85	8.00	+ 2.6	21	10,323	se.	78	se.	19	7	4	20	7.0	
Neah	50	7	24	29.93	29.99	− .05	49.4	− 1.0	65	4	54	35	*	45	17	48	46	89	11.22	+ 0.9	23	4,507	e.	26	w.	8	7	4	20	7.2	
Port Crescent	256	15	20	.....	.....	.....	47.4	− 0.2	70	4	54	27	14	41	26	....	....	....	5.07	+ 1.4	22	2,322	e.	18	w.	8	4	11	16	7.1	
Seattle	119	114	121	29.89	30.02	− .04	51.8	+ 0.2	81	4	58	33	14	46	34	48	45	82	3.34	− 0.1	17	4,026	se.	30	se.	19	4	8	19	7.1	
Tacoma	213	113	120	.....	.....	.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	.....	...	.....	...	...	...	...	....	
Astoria	.....	18	....	.....	.....	.....	53.2	− 1.0	80	4	59	36	14	48	19	....	....	....	10.28	+ 4.2	16	.....	e.	...	.....	...	8	6	17	....	
Portland, Oreg	153	208	213	29.87	30.03	− .05	51.8	− 1.6	77	4	59	34	14	49	24	48	44	78	3.97	− 0.1	11	5,347	se.	40	s.	16	4	14	13	6.6	
Roseburg	521	56	67	29.45	30.02	− .08	52.0	− 0.7	86	4	62	29	14	43	43	47	44	78	3.87	+ 1.1	13	1,989	e.	20	w.	19	11	10	10	5.4	
Mid. Pac. C'st Reg.							**53.2**	**− 1.3**										**67**	**3.92**	**+ 2.4**									**4.2**	
Eureka	64	60	69	29.99	30.05	.00	52.0	− 1.2	76	3	58	39	15	46	29	49	46	83	4.28	+ 1.8	12	3,997	se.	34	nw.	7	10	7	14	5.5	
Mount Tamalpais	2,375	11	18	27.52	29.99	.....	55.3	.....	88	8	61	37	12	50	24	47	37	63	4.26	....	11	13,561	nw.	71	nw.	10	16	5	10	4.6	
Red Bluff	334	54	58	29.61	29.96	− .04	61.0	− 2.5	94	8	71	42	15	51	35	50	39	54	3.02	+ 1.7	8	5,514	n.	42	se.	19	19	5	7	3.6	
Sacramento	71	106	117	29.88	29.96	− .03	60.4	− 1.4	95	8	70	40	15	51	36	52	43	59	4.46	+ 3.6	9	6,000	nw.	30	sw.	19	16	9	6	4.4	
San Francisco	153	161	167	29.83	29.99	− .01	59.3	0.0	94	8	66	46	13	52	30	54	50	78	3.92	+ 2.7	9	6,298	w.	41	w.	10	21	5	5	3.0	
Point Reyes Light †	.....	12	16	.....	.....	.....	55.2	+ 1.1	86	4	61	43	13	49	35	....	....	....	5.41	+ 3.1	8	6,805	nw.	70	nw.	9	12	2	17	5.7	
S. Pac. Coast Reg.							**61.5**	**− 1.9**										**70**	**1.97**	**+ 1.3**									**3.5**	
Fresno	332	67	70	29.61	29.96	.00	60.4	− 4.5	93	4	72	40	15	49	40	52	45	65	2.01	+ 1.5	8	3,439	w.	20	w.	22	16	7	8	4.1	
Los Angeles	330	74	82	29.59	29.94	− .01	63.4	− 0.3	100	8	74	45	29	53	40	55	49	72	1.59	+ 0.8	4	3,277	w.	30	sw.	13	13	15	3	3.8	
San Diego	87	94	102	29.84	29.94	− .02	62.7	− 0.5	93	8	68	48	15	57	33	56	51	73	0.35	0.0	3	4,267	nw.	26	sw.	13	25	3	3	2.8	
San Luis Obispo	201	10	46	29.78	30.00	+ .03	59.6	− 2.4	96	8	72	40	11	47	46	51	47	71	3.92	+ 2.9	7	3,161	n.	16	w.	10	18	10	3	3.2	
West Indies.																															
Basseterre	29	41	54	29.88	29.91	.....	80.4	.....	88	24	86	70	9	75	15	75	73	78	6.64	.....	14	5,297	e.	42	sw.	9	3	21	7	6.1	
Bridgetown	30	57	65	29.86	29.90	.....	80.6	.....	89	10	87	72	26	75	15	76	74	81	5.08	.....	15	4,716	e.	22	s.	11	1	19	11	6.8	
Cienfuegos	52	62	67	29.81	29.86	.....	78.9	.....	92	11	86	68	31	72	21	74	73	88	3.72	.....	16	5,493	ne.	26	ne.	24	3	16	12	6.0	
Havana	57	83	100	29.85	29.91	.....	78.2	.....	89	4	83	68	8	73	15	73	71	79	5.82	.....	17	10,850	ne.	51	ne.	24	4	17	10	5.7	
Kingston	358	55	62	29.56	29.86	.....	78.8	.....	91	8	86	69	14	72	18	73	71	85	21.64	.....	20	4,230	ne.	36	se.	28	4	11	16	7.1	
Port of Spain	286	38	52	29.83	29.87	.....	80.6	.....	91	2	89	70	2	72	21	75	73	79	5.30	.....	14	2,624	e.	18	e.	30	5	23	3	5.7	
Puerto Principe	40	65	66	29.51	29.85	.....	78.2	.....	91	5	86	66	15	70	21	74	73	89	8.64	.....	17	5,516	ne.	33	e.	27	4	12	15	6.7	
Roseau	25	37	47	29.87	29.89	.....	81.9	.....	92	4	89	73	21	75	17	74	71	72	1.60	.....	9	3,757	ne.	27	s.	9	15	14	2	4.3	
San Juan	82	48	90	29.82	29.90	.....	79.5	....	90	10	85	68	1	74	17	75	73	82	10.21	+ 4.0	20	5,793	se.	38	sw.	2	6	12	13	6.0	
Santiago de Cuba	82	45	51	29.76	29.84	.....	79.4	.....	91	8	86	69	13	72	19	73	72	84	19.06	.....	23	3,609	ne.	30	se.	29	2	17	12	6.9	
Santo Domingo	57	37	44	29.84	29.90	.....	77.6	.....	89	8	84	68	8	71	21	74	72	86	14.71	.....	19	3,273	n.	20	s.	27	9	12	10	5.4	
Willemstad	75	39	46	29.77	29.84	.....	82.8	.....	89	28	87	73	8	78	12	77	75	78	1.42	.....	8	6,026	e.	23	e.	28	6	24	1	5.2	

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. *Two or more dates. †Received too late to be considered in departures, etc.

TABLE II.—*Climatological record of voluntary and other cooperating observers, October, 1899.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alco	88	47	68.6	3.59	
Ashville	91	35	63.0	1.30	
Bermuda	86	40	67.6	2.78	
Birmingham	87	42	68.9	1.53	
Bridgeport				5.28	
Citronelle	85	48	70.0	1.81	
Clanton	83	39	63.2	1.71	
Daphne	86[e]	47[e]	69.6[e]	1.80	
Decatur	86	34	64.5	1.52	
Demopolis				1.29	
Elba	89[b]	40[e]	64.4[e]	2.77	
Eufaula[a]	89	42	66.3	4.43	
Evergreen	85	48	66.4	2.40	
Florence[a]				1.31	
Florence[b]	87	39	65.9	1.11	
Fort Deposit	85	39	66.2	2.20	
Gadsden	90	36	65.4	1.28	
Goodwater	88	42	65.6	2.21	
Greensboro	87	42	68.4	0.87	
Healing Springs	91	39	66.0	1.58	
Highland Home	84	47	67.9	2.58	
Jasper				1.56	
Livingston[a]	87	40	66.6	1.21	
Livingston[b]	86	39	67.6	1.18	
Lock No. 4	84	39	63.3	1.19	
Madison Station	90	42	66.6	1.31	
Maplegrove	85	31	63.0	1.34	
Marion	90	46	68.4	3.30	
Mount Willing	89	43	70.2	3.52	
Newbern	87	43	68.8	1.79	
Newton	84	44	64.6	7.03	
Oneonta	83	36	64.2	1.48	
Opelika	87	44	64.6	2.78	
Oxanna	85	38	65.0	1.94	
Pineapple	91	38	67.0	1.40	
Pushmataha	89	36	67.7	0.69	
Riverton	88	32	64.2	1.64	
Rockmills	86	42	65.8	3.97	
Scottsboro	89	35	61.9	1.99	
Selma	92	41	68.4	3.16	
Talladega	86	37	66.0	3.22	
Tallassee				3.79	
Thomasville	88	40	67.3	1.75	
Tuscaloosa	87	39	66.2	1.36	
Tuscumbia	85	36	64.4	1.24	
Union Springs	88	44	66.7	4.40	
Uniontown	91	43	70.0	1.81	
Valleyhead	84	40	63.7	3.61	
Warrior				0.55	
Wetumpka	89	44	67.0	4.36	
Wilson[*1]	90	47	69.9	3.09	
Alaska.					
Skagway	51	16	33.7	3.05	1.6
Arizona.					
Allaire Ranch				0.29	
Arivaca	98	31	64.4	0.83	
Arizona Canal Co. Dam	99	40	69.5	1.11	
Aztec[*1]	101	49	70.9	0.13	
Benson[*1]	91	43	69.8	1.32	
Bisbee	82	37	59.9	1.69	
Bowie[*1]	78	45	62.0	0.00	
Buckeye	98	35	67.5	0.10	
Camp Creek	87	39	63.6	1.10	
Casagrande[*1]	93	47	70.5	T.	
Champie Camp	98	38	69.5	0.80	
Cochise[*1]	82	38	58.9	0.00	
Congress	88	41	66.6	0.67	
Dragoon				0.00	
Dragoon Summit[*1]	80	42	56.2	0.90	
Dudleyville	90	31	63.8	0.05	
Fort Apache	87	22	56.8	0.82	
Fort Defiance	75[j]	21	43.0[e]	1.05	T.
Fort Grant	86	37	62.4	0.30	
Fort Huachuca	85	34	60.2	1.47	
Fort Mohave	102	41	69.8	0.43	
Gilabend[*1]	98	46	66.4	T.	
Holbrook	85	23	54.2	0.65	
Ingleside	100	39	69.2	0.48	
Jerome	85	34	58.5	2.05	
Lochiel[*1]	80	36	58.1	0.34	
Maricopa[*1]	100	48	75.0	0.06	
Mesa	99	36	66.6	0.31	
Mount Huachuca	80	33	58.0	2.13	
Music Mountain	91	30	61.2	0.24	
Natural Bridge				3.66	
Nogales	90	31[d]	64.6	1.06	
Oracle	84	35	61.2	0.28	
Oro				0.41	
Pantano[*1]	87	50	63.3	1.30	
Peoria	98	40	69.8	0.44	
Phenix	96	36	66.9	0.34	
Pima	94	30	62.4	0.30	
Pinal Ranch				0.48	
Prescott	82	25	52.2	1.34	
San Carlos	99	32	65.5	0.32	
San Simon[*1]	86	45	61.8	1.00	
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sentinel[*1]	107	50	75.6	0.00	
Signal	100	35	66.5	0.73	
Silverking				0.43	
Snowflake	88	15	50.8	0.85	
Strawberry	77	27	50.2	3.89	T.
Supai	95	40	63.3	0.27	
Texas Hill[*1]	104	50	72.5	0.42	
Tonto		36		1.85	
Tuba	95	30	58.4	0.25	
Tucson	93	32	67.1	0.67	
Vail[*5]	86	48	67.5	0.19	
Walnut Grove				1.14	
Whitehills	90	46	63.8	0.30	
Willcox[*1]	88	38	62.3	0.22	
Winslow	85	24	53.2	0.98	
Yarnell				1.30	
Arkansas.					
Amity	90	34	66.0	3.05	
Arkansas City				1.30	
Beebranch	89[j]	35[j]	67.2[j]	4.10[e]	
Blanchard Springs	89	32	66.2	2.30	
Brinkley	89	40	67.6	1.40	
Camden[a]				1.20	
Camden[b]	90	36	65.8	2.28	
Canton	88	31	62.1	4.71	
Conway	101	35	68.4	2.90	
Corning	94	31	62.6	3.61	
Dallas	89	42	66.6	2.06	
Dardanelle				3.13	
Elon	92	34	67.8	3.86	
Fayetteville	90	33	64.6	6.57	
Forrest	92	38	65.8	2.14	
Fulton				2.20	
Hardy	87	37	63.4	4.46	
Helena[a]				0.81	
Helena[b]	93	41	67.6	0.76	
Hot Springs[a]	94	37	67.8	1.52	
Hot Springs[b]				2.00	
Jonesboro	88	30	64.2	2.69	
Keesees Ferry	92	32	64.2	3.45	
Lacrosse	88[d]	36[d]	64.3[d]	4.00	
Lonoke	89	35	65.6	2.15	
Luna Landing[*6]	87	40	65.7	1.23	
Malvern	98	34	65.6	1.60	
Marianna	85	37	63.8	2.62	
Marvell	89	38	66.3	2.19	
Moore				4.10	
Mossville	86	28	62.6	6.41	
Nashville	91	37	68.2	3.19	
New Gascony	88	39	65.0	1.25	
Newport[a]				2.27	
Newport[b]	92	36	64.8	2.16	
Newport[c]	90	33	64.0	2.32	
Oregon	92	33	64.6	3.03	
Osceola	94	37	66.8	2.40	
Ozark	91	41	68.7	3.85	
Pinebluff	93	37	66.4	2.04	
Pocahontas	85	37	62.2	3.01	
Pond	89	31	61.8	5.03	
Powell	94	31	64.5	2.59	
Prescott	95	39	67.4	2.30	
Rison	93	33	67.4	1.56	
Russellville	88	36	64.6	3.65	
Silversprings	92	32	65.0	5.28	
Spielerville	94	34	67.6	2.76	
Stuttgart	92	34	66.6	3.96	
Texarkana	92	37	69.0	3.24	
Warren	92	38	66.4	1.73	
Washington	89	40	68.4	1.82	
Wiggs[*1]	90	31	69.4	2.42	
Winslow	83	37	63.2	6.52	
Witts Springs	88	32	62.2	3.70	
California.					
Angiola	96	35	59.5	1.02	
Arlington Heights	94	40	63.0	1.03	
Bakersfield	95	34	60.3	0.57	
Ballast Point L. H.				0.25	
Bear Valley				14.16	33.5
Berkeley	94	45	58.4	5.26	
Bishop	92	19	53.4	0.14	
Boca[*1]	74	10	37.0	4.42	29.0
Bodie	69	0	35.0	0.90	7.5
Bowman				16.27	27.0
Cahto				6.41	
Caliente[*1]	89	44	61.6	0.25	
Campbell	95	36	57.6	3.08	
Cape Mendocino L. H				6.32	
Cedarville	80	20	44.2	3.76	8.0
Centerville[*1]	103	46	61.4	4.24	
Chico[*1]	102	44	63.3	2.95	
Cisco[*1]	72	12	39.8	12.83	40.0
Corning[*1]	100	44	62.8	6.76	
Coronado	81	55	62.6		
Craftonville	95	41	62.4	1.37	
Crescent City	80	32	51.8	8.36	
Crescent City L. H				7.65	
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cuyamaca	72	23	47.0	4.51	
Delano[*5]	87	43	62.6	0.78	
Delta[*1]	90	38	57.0	9.85	
Dewey	93	38	60.5	0.70	
Drytown	92	38	60.8	5.98	
Dunnigan[*1]	97	42	64.4	3.33	
Durham[*1]	96	42	61.2	4.94	
East Brother L. H				3.25	
Edmanton[*1]	82	28	45.4	15.38	19.0
Elcajon	100	37	62.8	0.67	
Elmwood	95	36	59.8	2.92	
Elsinore	102	33	62.0	0.98	
Escondido	100	31	58.8	0.61	
Fallbrook[*1]	98	44	59.2	1.25	
Folsom[*1]	96	43	59.7	5.74	
Fordyce Dam				13.85	56.0
Fort Bragg				4.38	
Fort Ross	97	41	56.4	5.05	
Fort Tejon				1.10	
Georgetown	90	32	54.6	9.87	
Gilroy (near)	98	33	59.0	2.74	
Goshen[*1]	93	40	61.2	1.62	
Grand Island[*5]	97	42	62.8	4.23	
Grass Valley				10.33	
Greenville	89	22	47.2	10.08	8.5
Hanford	93	35	59.0	0.67	
Healdsburg	107[e]	29[e]	58.0[e]	5.65	
Hollister	97	35	59.2	2.19	
Humboldt L. H				4.70	
Indio[*1]	100	54	71.4	0.00	
Iowa Hill[*1]	90	36	54.6	9.18	
Irvine	102	48	70.0	1.14	
Jackson	82	30	53.0	5.86	
Jolon				2.10	
Keene				0.61	
Kennedy Gold Mine	85	33	55.6	8.18	
Kernville				0.90	
King City				1.73	
Kingsburg[*5]	90	40	62.6	1.80	
Kono Tayee	90	39	58.6	3.78	
Lagrange[*5]	92[e]	44[e]	60.4[e]	2.60	
Lamesa				0.60	
Lankershim	93	38	59.0	2.30	
Laporte[*1]	75	24	43.5	18.30	27.3
Las Fuentes Ranch				2.26	
Legrand		38		3.36	
Lemoncove	96	40	63.4	1.80	
Lemoore[a*1]	87	38	56.4	1.42	
Lick Observatory	75	31	50.2	6.37	1.5
Lime Point L. H				3.06	
Lodi	92	40	59.8	3.74	
Los Gatos[b]	93	37	57.2	5.55	
Malakoff Mine	88	31	52.5	14.52	T.
Mammoth[*1]	100	50	73.0	0.00	
Manzana	92	37	59.6	1.27	
Mare Island L. H				2.96	
Merced[b]	93	37	60.0	2.16	
Mills College				4.60	
Milo				1.92	
Milton (near)[*1]	91	42	60.2	4.49	
Modesto[*1]	95	43	62.9	1.96	
Mohave[*1]	90	40	60.7	0.68	
Mokelumne Hill[*5]		40	54.9	5.45	
Monterey[*1]	84	42	60.1	3.69	
Monterio	90	38	62.1	1.34	
Morena Dam	88	30	57.4	1.05	
Mountainview				2.76	
Mutah Flat				2.00	
Napa[b]	102	38	60.2	3.89	
Needles	97	46	70.4	0.19	
Nevada City	87	29	50.9	10.24	
Newhall[*1]	92	36	61.2	1.63	
North Ontario	90	40	60.6	1.73	
North San Juan[*1]	85	31	53.9	10.04	
Oakland[a]	94	43	57.3	4.89	
Ogilby[*1]	105	50	71.1	0.00	
Oleta[*1]	86	32	53.4	6.98	
Orland[*1]	95	40	60.0	2.03	
Palermo	98	40	60.0	5.76	
Paso Robles[b]	93	39	58.8	2.55	
Peachland[*5]	98	40	58.2	6.57	
Piedras Blancas L. H				2.96	
Pigeon Point L. H				4.56	
Pilot Creek				10.92	20.0
Pine Crest	93	46	64.0	2.45	
Point Ano Nuevo L. H				3.15	
Point Arena L. H				3.60	
Point Bonita L. H				3.98	
Point Conception L. H				0.82	
Point Firmin L. H				0.82	
Point George L. H				2.14	
Point Hueneme L. H				1.37	
Point Lobos	77	45	56.2	3.19	
Point Lome L. H				0.18	
Point Montara L. H				4.80	
Point Pinos L. H				2.99	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Point Sur L. H	.....	.....	.....	5.27	
Pomona (near)	95	38	62.7	1.92	
Poway[*3]	92	42	57.6	0.78	
Quincy	81	25	46.0	11.88	6.5
Ranch House	96	44	67.8	1.21	
Redding	94	41	60.4	4.83	
Redlands	96	41	63.6	0.65	
Reedly	98	30	56.9	.....	
Represa	92	40	59.8	6.39	
Riovista	97	41	60.6	4.47	
Roe Island L. H	.....	.....	.....	3.11	
Romie	100	34	59.2	1.59	
Rosewood	94	34	56.5	2.30	
Sacramento *a*	92	38	58.8	5.09	
Salinas[*1]	94	40	55.5	1.14	
Salton[*5]	104	55	78.1	0.14	
San Bernardino	100	33	62.4	0.81	
San Jacinto	94	37	61.0	0.81	
San Leandro[*1]	102	47	61.2	4.38	
San Luis L. H	.....	.....	.....	3.27	
San Mateo[*1]	93	45	61.0	3.89	
San Miguel[*1]	94	41	60.7	2.35	
Santa Barbara *a*	93	47	62.4	2.06	
Santa Barbara L. H	.....	.....	.....	1.78	
Santa Clara *a*	.....	.....	.....	3.69	
Santa Cruz *b*	92	33	56.0	7.05	
Santa Cruz L. H	.....	.....	.....	7.04	
Santa Maria	94	43	61.2	1.86	
Santa Monica[*1]	82	49	63.6	1.33	
Santa Rosa[*1]	99	41	58.4	5.94	
Shasta	93	32	59.9	5.39	
Sierra Madre	92	43	62.4	2.80	
Snedden	.....	.....	.....	1.50	
Sonoma	.....	.....	....	6.27	
S. E. Farallone L. H	.....	.....	....	5.83	
Stanford University	94	39	58.2	2.64	
Stockton *a*	89	40	59.4	3.59	
Summerdale	77	20	45.4	7.11	32.0
Susanville	78	24	44.6	5.21	19.0
Tehama[*1]	95	45	62.3	2.06	
Tejon Ranch	90	43	62.8	1.31	
Templeton[*1]	95	40	53.2	3.10	
Thermalito	100	41	61.7	7.77	
Trinidad L. H	.....	.....	.....	4.70	
Truckee[*1]	80	28	48.4	6.49	56.0
Tulare *b*	.....	.....	.....	1.21	
Tulare *c*	96	38	60.4	1.35	
Ukiah	98	32	56.6	4.06	
Upperlake	101	33	56.0	3.49	
Upper Mattole[*1]	101	41	57.6	9.54	
Vacaville *a*[*1]	99	44	62.4	3.61	
Ventura	92	40	60.2	1.56	
Visalia *b*	95	37	60.0	0.85	
Volcano Springs[*1]	106	52	69.9	0.19	
Walnut Creek	97	40	61.0	3.23	
West Palmdale	.....	.....	.....	1.28	
Westpoint	.....	.....	.....	7.37	3.0
West Saticoy	.....	.....	.....	2.08	
Wheatland	97	38	58.8	5.73	
Williams[*1]	99	47	63.9	3.28	
Wilmington[*1]	98	40	61.6	0.96	
Wire Bridge[*5]	96	39	58.8	6.53	
Yerba Buena L. H	.....	.....	.....	3.70	
Yreka	79	26	49.1	2.34	
Colorado.					
Antlers	80	20	48.4	4.01	
Arkins	.....	.....	.....	3.30	
Aspen	.....	.....	.....	4.20	33.5
Boulder	87	29	50.5	1.94	2.0
Boxelder	.....	.....	.....	2.51	8.0
Breckenridge	62	4	30.4	2.54	36.6
Buenavista	.....	.....	.....	1.41	10.0
Canyon	89	27	54.2	1.08	
Castlerock	83	16	47.8	1.30	7.0
Cedaredge	77	20	47.9	2.63	4.5
Cheyenne Wells	93	26	53.1	T.	
Clearview[*1]	66	14	36.7	2.66	29.5
Colorado Springs	82	26	49.2	1.09	9.0
Cope	90	25	50.2	0.04	
Cripplecreek	72	10	39.0	0.75	9.0
Crook	94	19	50.6	T.	
Delta	89	21	50.2	1.15	
Dumont	.....	.....	....	3.55	13.0
Durango	77	21	48.4	2.22	
Fairview	78	12	45.0	1.69	1.70
Fort Collins	87	22	46.4	3.23	
Fox	.....	.....	.....	T.	
Garnett	75	11	43.0	0.82	2.0
Georgetown	64	18	42.0	.....	
Gilman	.....	.....	.....	3.41	19.0
Gleneyrie	79	27	48.0	1.40	10.0
Glenwood	.....	.....	.....	2.57	7.5
Greeley	88	25	47.6	1.85	1.0
Gunnison	72	13	40.6	0.77	1.5
Gypsum	.....	.....	.....	2.86	13.0
Hamps	84	19	48.0	0.49	T.
Hoehne	85	20	52.4	2.01	6.0
Holly	.....	.....	.....	0.24	
Holyoke (near)	97	12	50.4	0.05	
Hugo	.....	.....	.....	0.00	
Husted	86	20	47.6	1.37	11.0
Lake Moraine	66	−8	37.0	2.40	28.2
Lamar	95	22	56.2	0.95	
Laporte	.....	.....	.....	3.02	
Las Animas	89	22	55.8	1.00	
Leadville (near)[*1]	65	12	34.0	2.47	33.0
Leroy	91	26	50.0	0.30	
Longs Peak	69	8	37.4	2.50	29.0
Mancos	80	18	48.0	1.92	0.5
Marshall Pass	.....	.....	.....	1.51	20.
Meeker	71	15	41.0	4.60	19.
Minneapolis	89	22	55.6	0.60	
Mitchell	.....	.....	.....	3.91	37.0
Montrose	.....	.....	.....	1.83	5.5
Moraine	69	15	39.5	1.96	21.5
Pagoda	80	14	42.4	.....	.....
Palmer	.....	.....	.....	1.01	10.1
Parachute	85	25	48.6	6.36	
Perrypark	.....	.....	.....	0.70	
Rangely	73	14	43.0	1.27	
Rockyford	92	22	53.9	0.63	
Ruby	.....	.....	.....	1.62	22.0
Saguache	74	22	46.6	0.38	
Salida	79	19	48.4	0.60	6.0
San Luis	74	15	45.4	1.43	3.0
Santa Clara[*1]	74	17	42.6	3.12	25.0
Sapinero	.....	.....	.....	2.	4.0
Seibert	.....	.....	.....	T.	
Springfield	.....	.....	.....	T.	
Strickler Tunnel	.....	.....	.....	2.27	29.0
Trinidad	.....	.....	.....	2.47	7.0
T. S. Ranch	81	26	48.4	2.60	3.0
Twinlakes	.....	.....	.....	2.04	6.5
Vilas	.....	.....	.....	0.28	
Wagon Wheel	72	10	39.4	2.85	6.0
Westcliffe	72	12	42.0	1.11	11.7
Wray	95	22	49.6	T.	
Yuma	.....	.....	.....	0.03	
Connecticut.					
Bridgeport	77	27	54.6	2.29	
Canton	86	21	51.8	2	T.
Colchester	81	23	53.9	.21	
Falls Village	.....	.....	.....	63	
Greenfield Hill	.....	.....	.....	2.09	
Hartford *a*	73	27	53.5	3.19	
Hartford *b*	.....	.....	.....	2.81	T.
Hawleyville	84	20	53.8	1.48	
Lake Konomoc	.....	.....	.....	1.51	
New London	77	36	56.7	1.87	
North Franklin	.....	.....	.....	2.30	
North Grosvenor Dale	81	20	52.2	1.19	
Norwalk	78	24	53.8	1.42	
Southington	75	22	53.8	2.35	
Storrs	79	25	52.6	1.54	
Voluntown	78	20	53.4	1.43	
Wallingford	.....	.....	.....	2.49	
Waterbury	84	21	54.8	2.42	
West Cornwall	74	25	51.4	1.67	
West Simsbury	.....	.....	.....	1.87	T.
Winsted[*1]	76	24	50.2	.....	
Delaware.					
Milford	83	33	61.6	4.35	
Millsboro	80	31	58.6	5.34	
Newark	67	29	55.8	2.02	
Seaford	77	31	57.3	2.73	
District of Columbia.					
Distributing Reservoir[*5]	75	34	58.3	1.57	
Receiving Reservoir[*5]	74	34	56.0	1.17	
West Washington	80	30	58.0	3.01	
Florida.					
Archer	89	54	72.8	2.04	
Bartow	89	58	74.8	6.51	
Brooksville	88	56	72.8	4.54	
Carrabelle	93[d]	57[d]	74.0[d]	2.50	
Clermont	94	58	74.4	5.75	
Dalkeith	89	.....	.....	5.05	
De Funiak Springs	90	49	70.2	6.15	
Estero[*1]	87	67	75.5	.....	
Eustis	90	54	73.7	3.23	
Federal Point	85	56	72.6	4.81	
Fort Meade	88	60	75.4	7.75	
Gainesville	88	56	72.3	1.76	
Homeland	84	54	71.3	.....	
Huntington	84	54	71.8	5.52	
Inverness	89	53	73.5	2.46	
Jasper	88	53	70.1	2.12	
Kissimmee	91	53	76.3	15.98	
Lake City	90	53	72.0	2.75	
Lemon City	92	62	78.2	10.20	
Maccleny	93	51	70.6	2.49	
Manatee	87	61	74.2	4.61	
Merritt Island	86	59	76.7	21.88	
Myers	86	62	76.0	2.58	
New Smyrna	87	58	74.8	14.86	
Ocala	91	53	73.4	3.19	
Orange City	87	57	74.7	8.48	
Orlando	87	57	74.6	9.22	
Plant City	90	58	74.8	3.82	
Rockwell	89	.....	.....	1.53	
St. Andrews	87	52	70.6	4.02	
St. Francis	89	54	73.0	4.32	
St. Francis Barracks	82	57	70.0	7.95	
Sebastian	86	58	73.2	29.10	
Stephensville[*1]	88	56	70.6	0.97	
Switzerland[*1]	86	55	70.3	2.27	
Tallahassee	84	55	69.4	3.85	
Tarpon Springs	87	56	73.0	1.15	
Georgia.					
Adairsville	81°	38°	62.8°	0.74	
Alapaha	88	51	68.0	4.53	
Albany	89	50	69.2	4.06	
Allentown	92	40	69.2	7.12	
Americus	86	46	66.2	5.17	
Athens *b*	83	42	61.9	3.59	
Bainbridge	84	52	68.4	3.49	
Bellville	.....	.....	.....	2.73	
Blakely	86	50	69.0	3.35	
Camak	85	41	63.6	5.92	
Carlton	.....	.....	.....	3.63	
Clayton	81	31	58.4	3.95	
Columbus	83	50	67.2	4.56	
Covington	91	41	64.4	4.62	
Crescent	.....	.....	.....	1.88	
Dahlonega	84	36	60.7	2.64	
Diamond	78	.....	.....	3.88	
Dublin	.....	.....	.....	3.15	
Eastman	88	44	67.3	5.05	
Elberton	87	43	65.0	4.55	
Fitzgerald	90	49	67.5	3.98	
Fleming	89	50	67.0	4.26	
Fort Gaines	86	48	67.3	8.20	
Franklin	85	44	65.8	4.85	
Gainesville	82	41	61.4	2.43	
Gillsville	88	40	63.4	2.37	
Greenbush	81°	34°	61.3°	1.55	
Griffin	89	39	64.4	4.99	
Harrison	.....	.....	.....	4.00	
Hawkinsville	86	45	65.0	5.98	
Hephzibah[*6]	82	50	67.9	3.90	
Jesup	94	47	68.0	2.10	
Louisville	90	45	65.8	3.70	
Lumpkin	88	49	67.8	4.76	
Marshallville	86	48	67.2	8.24	
Mauzy	92	52	69.8	3.71	
Millen	90	45	66.4	3.78	
Morgan	88	50	68.9	3.64	
Newnan	81	42	62.0	5.09	
Oakdale	.....	.....	.....	3.13	
Pelham	.....	.....	.....	3.89	
Point Peter	82	40	60.6	4.38	
Poulan	89	49	68.0	4.29	
Putnam	87	45	65.9	6.79	
Quitman	89	40	68.4	2.06	
Ramsey	83	32	63.2	1.76	
Rome	82	37	62.7	0.89	
Talbotton	89	45	66.2	7.57	
Tallapoosa	82	39	60.7	3.21	
Thomasville	90	53	70.8	3.31	
Toccoa	85	40	62.2	3.20	
Union Point	82	42	63.0	3.60	
Washington	82	42	63.4	3.53	
Way Cross	91	49	69.6	1.39	
Waynesboro	85	40	63.2	4.15	
Westpoint	85	44	65.2	2.62	
Idaho.					
American Falls	85	17	46.7	2.11	
Atlanta	75	14	37.6	3.74	9.8
Blackfoot	76	20	42.9	3.11	0.5
Burnside	75	17	40.8	0.42	T.
Chesterfield	70	4	37.0	2.25	7.0
Downey	76	11	41.2	1.46	5.8
Fort Sherman	80	16	45.2	2.74	T.
Gray	76	18	43.0	2.22	22.0
Hagerman	90	24	50.4	0.73	
Idaho City	76[b]	18[b]	42.2[b]	5.48	6.5
Kootenai	69	21	45.9	1.91	
Lake	74	12	37.4	2.05	20.5
Lakeview	68	27	45.9	3.00	T.
Lewiston	74	36	55.0	2.27	
Lost River	74	19	40.8	0.55	4.0
Marysville	82	10	37.4	1.66	14.0
Moscow	78	11	44.6	2.68	4.0
Murray	70	18	41.9	3.43	T.
Oakley	83	21	46.6	1.00	T.
Ola	77	22	45.8	3.48	
Paris	79	19	41.2	1.65	6.0
Payette	82	20	48.4	2.99	
Pollock	88	29	48.1	1.41	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Priest River	75	10	44.0	2.68	T.
St. Maries	76	23	47.0	3.44	
Salubria	79	15	45.2	2.40	0.1
Soldier	78	11	40.4	1.94	9.0
Swan Valley	76	8	40.0	2.33	19.5
Van Wyck	79	4	41.0	.....	.....
Weston	.....	.....	.....	1.96	
Yellow Jacket	.....	.....	.....	0.94	.....
Illinois.					
Albion	88	36	60.8	3.15	
Alexander	92	31	62.6	3.07	
Ashton	87	27	55.8	1.99	
Astoria	86	30	58.5	3.43	
Aurora *a*	88	29	57.0	2.13	
Aurora *b*	88	28	56.4	2.39	
Bloomington	91	30	60.6	2.69	
Bushnell	91	33	60.8	2.61	
Cambridge	86	34	57.4	3.89	
Carlinville	90	31	62.1	3.91	
Carlyle	.....	.....	.....	3.70	
Charleston	92	34	61.1	4.13	
Chemung	86	25	54.5	1.44	
Chester	.....	.....	.....	3.36	
Cisne	92	32	61.1	5.26	
Coatsburg	91°	35	61.0°	3.13	
Cobden	92	35	63.0	4.65	
Danville	88	29	58.0	3.36	
Decatur	94	29	60.9	4.20	
Dixon	89	30	58.3	3.48	
Dwight	88	26	56.5	2.31	
Effingham	90	34	60.2	3.90	
Elgin	88	29	55.0	2.39	
Equality	87	32	62.0	4.25	
Flora	90	34	60.2	4.54	
Fort Sheridan	86	32	56.3	1.85	
Friendgrove [1]	90	38	63.2	4.54	
Galva	89	32	57.9	4.34	
Glenwood [1]	82°	30°	55.2°	3.19	
Grafton	..	...	.....	4.75	
Grayville	87	39	63.3	3.80	
Greenville	89	35	61.1	2.98	
Griggsville	90	34	62.0	3.33	
Halfway	88	36	63.0	4.49	
Halliday	91	32	61.0	4.71	
Havana	86	38	60.9	3.34	
Henry	90	27	58.0	3.45	
Hillsboro	90	33	61.4	3.67	
Joliet	85	30	56.8	2.39	
Knoxville	89	28	57.0	2.48	
Lagrange	86	30	56.4	2.54	
Laharpe	91	31	59.8	1.97	
Lanark	87	24	55.6	2.67	
Loami	.....	.....	.....	5.09	
McLeansboro	89	34	61.6	4.03	
Martinsville	87	34	60.6	2.79	
Martinton	88	27	58.2	3.17	
Mascoutah	90	32	60.8	3.36	
Mattoon	88	36	62.9	3.18	
Minonk	89	29	57.9	3.47	
Monmouth	90	28	58.2	2.38	
Monticello [2]	87	33	60.5	4.34	
Morgan Park	85	30	57.2	2.48	
Morrisonville	87	33	59.7	3.75	
Mount Carmel	.....	...	.....	4.89	
Mount Pulaski	93	32	60.8	3.04	
Mount Vernon	90	30	59.4	3.95	
New Burnside	91	32	64.0	5.18	
Olney	89	35	61.0	2.86	
Ottawa	90	28	58.2	2.53	
Palestine	88	31	59.8	2.99	
Pana	91	32	59.8	3.97	
Peoria *a*				3.25	
Peoria *b*	88	33	59.7	2.78	
Philo	92	28	58.2	4.22	
Plumhill	94	34	62.6	3.32	
Rantoul	90	31	58.6	4.50	
Raum	88	36	63.6	3.62	
Riley	87	29	56.1	1.72	
Robinson	91	34	61.8	3.45	
Roundgrove	89	29	57.1	3.39	
St. Charles [1]	85	30	54.1	2.20	
St. John	92	34	62.0	4.08	
Savanna [4]	88	24	55.4	2.59	
Scales Mound	85	23	54.6	1.08	T.
Shobonier	91	30	61.3	3.32	
Strawn	89	30	58.8	2.60	
Streator	90	23	57.5	2.47	
Sullivan	91	30	60.2	3.73	
Sycamore	87	29	55.6	2.44	
Tilden	92	30	61.9	2.75	
Tiskilwa	85	33	57.1	3.73	
Tuscola	93	30	59.4	3.90	
Walnut	89	31	57.8°	2.78	
Wheaton [23]	.....	30	58.0	2.12	
Winchester	89	32	60.5	3.47	
Winnebago	87°	28°	56.6°	2.22	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana.	°	°	°	*Ins.*	*Ins.*
Anderson	89	26	58.9	2.45	
Angola	88	27	55.3	3.32	
Auburn	86	22	55.2	3.27	
Bloomington	86	30	59.5	2.91	
Bluffton	90	25	58.6	2.60	
Booneville	89	34	62.0	2.41	
Bright	89	34	60.6	1.71	
Butlerville	89	31	60.0	2.94	
Cambridge City	88	22	56.8	2.25	
Columbia City [1]	83	28	57.0	3.39	
Columbus	90	24	59.0	2.64	
Connersville	88	26	58.0	3.11	
Delphi	88	26	57.0	3.88	
Edwardsville [1]	84	43	63.8	2.76	
Fairmount	89	22	56.4	2.10	
Farmland	85	27	57.5	2.60	
Fort Wayne	87	25	56.0	2.30	
Franklin [1]	85	37	58.3	2.34	
Greencastle	83	34	59.3	2.77	
Greensburg	89	34	60.1	2.88	
Hammond	88	37	60.0	1.25	
Hector	86	27	59.0	2.06	
Huntington	86	31	58.4	3.26	
Jeffersonville	87	32	60.8	2.57	
Knightstown	88	28	58.7	2.59	
Kokomo	86	28	58.4	3.31	
Lafayette	87	29	58.8	3.27	
Laporte	92	29	57.8	3.42	
Logansport	85	30	55.4	2.71	
Madison	88	30	61.0	2.65	
Marengo	90	27	59.0	3.70	
Marion	88	27	58.8	2.35	
Markle	88	25	57.7	3.80	
Mauzy	89	26	58.8	2.64	
Michigan City [10]	76	29	56.2	.....	
Mount Vernon	94	32	63.7	3.21	
Northfield	85	25	57.0	2.69	
Paoli	88	29	60.5	2.85	
Peru	90	30	60.2	2.86	
Prairie Creek	93	32	61.4	2.95	
Princeton	90	31	60.2	3.80	
Richmond	87	25	57.5	2.60	
Rockport	86	37	62.8	2.90	
Rockville	89	32	59.6	3.70	
Salem	88	27	57.8	3.09	
Scottsburg	88	30	60.2	3.00	
Seymour	88	34	61.4	2.60	
Shelbyville	.....	.....	.....	2.46	
South Bend	88	31	57.8	3.70	
Syracuse	83	30	56.2	4.60	
Terre Haute	88	35	60.7	3.37	
Topeka	80	29	56.0	3.85	
Valparaiso	86	32	57.7	3.55	
Veedersburg	90	30	58.8	.....	
Vevay	90	33	61.4	1.75	
Vincennes	92	35	63.2	4.00	
Washington	95	35	64.7	3.05	
Winamac	87	26	57.8	3.16	
Worthington	93	28	60.9	3.49	
Indian Territory.					
Hartshorne	94	.....	.....	4.56	
Healdton	95	36	67.9	4.57	
Lehigh	92[k]	40[k]	65.6[k]	4.43	
Muscogee	94	37	67.5	5.77	
Ryan	99	40	69.8	4.26	
Sapulpa	95	36	66.8	4.81	
South McAlester	.....	.....	.....	5.85	
Tahlequah	90	35	64.8	7.30	
Tulsa	.....	.....	.....	6.40	
Webbers Falls	.....	.....	.....	5.24	
Iowa.					
Afton	89	28	58.8	1.53	
Albia	87	27	58.6	2.17	
Algona [1]	82	32	54.7	2.45	T.
Alta *a*	88	28	55.0	1.98	
Amana	86	29	57.0	0.98	
Ames *b*	88	23	57.2	.....	
Ames (near)	.....	.....	.....	2.03	
Atlantic	90	26	56.8	3.66	
Audubon	88	30	56.4	2.80	
Bancroft	85	22	53.2	2.16	
Baxter	88	28	58.4	0.64	
Bedford	94	25	60.7	1.89	
Belknap	90	31	59.9	1.20	
Bellplaine	86	25	56.2	1.15	
Blockton	89	28	59.4	2.45	
Bonaparte	92	29	59.4	1.20	
Britt	85	21	53.2	1.44	T.
Buckingham	.....	.....	.....	0.62	
Bussey	.....	.....	.....	1.55	
Carroll	92	25	55.4	1.79	
Carson	.....	.....	.....	3.16	
Cedarfalls	87	25	54.4	3.04	
Cedar Rapids	88	31	59.6	0.88	
Centerville	91	30	59.8	0.35	
Chariton	89	27	59.8	2.09	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Charles City	84	24	54.4	1.73	
Chillicothe	.....	.....	.....	1.95	
Clarinda	93	29	60.2	3.21	
Clinton	88	27	56.2	1.48	
College Springs	91	32	60.0	2.42	
Coon Rapids	86	29	57.4	2.23	
Corning	89	28	58.2	2.35	
Council Bluffs	93	30	59.2	1.87	
Cresco	83	25	52.2	1.55	
Cumberland	.....	.....	.....	3.30	
Danville	.....	.....	.....	1.47	
Decorah	85	23	55.4	1.04	
Delaware	85	26	55.5	1.14	
Denison	91	28	58.8	3.20	
Desoto	88	24	57.6	1.38	
Diagonal	89	25	56.2	1.10	
Dows	87	18	55.8	0.69	
Eldon	93	27	60.2	0.86	
Elkader	88	27	55.4	3.09	
Emerson	.....	.....	.....	1.50	
Emmetsburg	.....	.....	.....	3.05	
Fairfield [1]	92	30	59.9	.....	
Fayette	84	25	54.7	4.42	
Fonda	90	27	58.7	2.90	
Forest City	85	22	55.4	1.61	
Fort Madison	.....	.....	.....	1.94	
Galva	90	27	55.8	1.57	
Gilman	...	...	...	0.38	
Glenwood	92	32	60.5	3.57	
Grand Meadow [1]	83	30	53.8	2.02	
Greene	86	24	56.2	1.32	
Greenfield	91	31	58.6	1.67	
Grinnell	84	31	57.9	0.61	
Grinnell (near)	87	30	58.0	0.60	
Griswold	.....	.....	.....	3.25	
Grundy Center	86[f]	24[f]	53.8[f]	1.89	
Guthrie Center	87°	27°	60.2°	1.76	
Hamburg	.....	.....	.....	0.15	
Hampton	88	17	56.6	1.39	
Harlan	90	29	57.2	2.93	
Hawkeye	.....	..	.....	1.91	
Hopeville	88	32	59.0	1.48	
Hoprig	.....	.....	.....	2.30	
Humboldt	89	23	56.3	1.09	
Independence	86	23	55.6	0.72	
Indianola	88	27	59.6	0.68	
Iowa City	88	28	58.1	1.66	
Iowa Falls	87	23	55.4	1.67	
Keosauqua	92	29	60.7	1.02	
Knoxville	87	33	60.0	1.04	
Lacona	.....	.....	...	0.87	
Lamoni [3]	88	27	59.3	1.66	
Lansing	86	27	57.0	1.27	
Larrabee	88	25	52.8	1.42	
Leclaire	...	.....	...	1.70	
Lemars	88	27	54.7	1.55	
Lenox	88	32	59.0	2.01	
Logan	88	27	55.2	1.39	
Maple Valley	.....	.....	.....	2.10	
Maquoketa	88	24	56.2	1.59	
Marshalltown	87	23	58.4	0.62	
Mason City	87°	19°	52.6°	0.30	
Melrose	.....	.....	.....	0.33	
Monticello	88	25	56.6	1.10	
Mooar	95	29	60.2	2.73	
Mountayr	89	32	60.1	2.04	
Mount Pleasant	91	27	58.3	0.62	
Mount Vernon *a* [1]	86	30	58.0	1.30	
Mount Vernon *b*	87	28	59.0	1.28	
Murray	...	.....	.....	0.95	
New Hampton	84	25	55.8	1.31	
Newton	87	26	57.5	0.61	
Northboro	.....	.....	.....	2.94	
North McGregor	.....	.....	...	2.06	
Northwood	83	24	53.0	1.44	
Odebolt	90	27	56.7	1.95	
Ogden	89	26	58.8	2.01	
Olin	86	25	55.4	0.89	
Onawa	91	28	58.4	1.22	
Osage	83	22	53.2	0.87	
Osceola	90	30	59.6	1.75	
Oskaloosa	88	23	58.3	1.45	
Ottumwa [1]	92	33°	60.4	1.35	
Ovid	90	28	60.2	2.91	
Pacific Junction	93	29	58.8	2.28	
Pella	80	25	52.8	0.51	
Plover	90	26	55.6	2.38	
Primghar	88	30	52.6	1.25	
Redoak	93	34	60.9	4.09	
Ridgeway	88	28	55.6	2.07	
Rockwell City	89	29	55.9	2.03	
Ruthven	90	27	55.4	3.00	
Sac City	90	29	55.8	2.78	
Scranton	87	31	57.6	1.65	
Sheldon	.....	27	.....	4.39	
Sibley	87	24	52.8	2.68	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sigourney	88[4]	28	58.9	2.81	
Sioux Center	79	29	53.1	2.46	
Spirit Lake	87	28	54.6	2.07	
Storm Lake	86	30	55.0	2.12	
Stuart	88	32	57.2	1.55	
Thurman	92	31	59.0	4.64	
Toledo	90	22	58 3	0.49	
Villisca	90	29	58.8	2.82	
Wapello	88	29	58.8	1.07	
Washington	91	29	57.8	0.60	
Washta	.....	.....	.....	1.11	
Waterloo	87	24	56.2	1.55	
Waverly	86	27	56.4	2.61	
Westbend*[1]	86	25	52.0	2.27	
Westbranch	85	28	57.5	1.70	
West Union	.....	.....	.....	1.72	
Whitten*[1]	88	32	55.3	1.74	
Wilton Junction	90	26	56.8	1.64	
Winterset	90	28	55.8	1.20	
Woodburn	.....	.....	.....	1.12	
Kansas.					
Abilene	92	34	63.5	2.09	
Achilles	.....	.....	.....	0.02	
Altoona*[3]	94	31	60.4	2.15	
Anthony	.....	.....	.....	2.96	
Atchison *a*	93	34	63.6	0.66	
Atchison *b*	94	34	65.9	0.88	
Augusta	91	30	64.2	0.92	
Burlington	92	30	63.5	1.17	
Campbell	93	35	62.2	6.04	
Centropolis*[1]	98	34	63.2	1.10	
Colby	96	22	54.8	T.	
Columbus	94	35	63.5	4.67	
Coolidge	88	20	53.4	T.	
Cunningham	91	34	61.4	1.64	
Delphos	94	32	61.9	4.05	
Dresden	89	27	54.8	T.	
Ellinwood	92	31	59.7	2.78	
Emporia	89	27	61.7	0.50	
Englewood	94	30	61.4	1.53	
Eskridge	92	35	65.3	1.10	
Eureka	.....	.....	.....	1.01	
Eureka Ranch	90	26	59.0	0.55	
Fallriver	94	28	65.0	2.16	
Fanning	92	30	61.8	1.50	
Frankfort	95	31	62.2	3.10	
Garden City	90	25	57.2	0.75	
Garfield	.....	.....	.....	4.39	
Gibson	93	27	58.6	0.66	
Grenola	93	28	64.4	2.53	
Halstead	90°	33°	64.8°	1.61	
Hays	93	28	59.8	2.00	
Horton	91	34	62.8	2.09	
Hutchinson	92	38	64.6	2.05	
Independence	94	33	65.6	2.65	
Lawrence	90	35	63.2	0.60	
Lebo	93	34	64.0	0.71	
Macksville	91	31	60.8	3.05	
McPherson	93	34	62.5	3.14	
Manhattan *b*	95	32	64.0	1.89	
Manhattan *c*	94	29	64.4	1.82	
Marion	88	36	63.6	3.10	
Medicine Lodge	94	33	62.6	2.84	
Minneapolis	89	33	61.4	2.47	
Morantown	91	35	64.2	2.08	
Mounthope*[1]	89	38	62.0	1.69	
Ness City	90°	31°	59.8°	1.29	
Newton	94	34	64.0	2.16	
Norwich	92	37	64.2	2.45	
Oberlin	.....	.....	.....	0.00	
Olathe	94	30	64.5	0.73	
Osage City	93	28	63.2	1.02	
Oswego	94	38	68.4	3.28	
Ottawa	94	28	63.0	1.00	
Paola	92	27	60.9	1.10	
Phillipsburg	100	30[c]	60.4[d]	0.26	
Pratt	90	33	60.7	1.78	
Rome*[1]	92	32	64.0	1.22	
Russell	92°	31°	60.3°	3.65	
Salina	94	33	62.6	1.75	
Scott	90	19	54.2	0.24	
Sedan	93	30	64.1	2.44	
Seneca	94	33	59.8	2.65	
Toronto	96	27	62.4	2.05	
Tribune	90	22	53.4	0.03	
Ulysses	92	21	58.0	0.71	
Valley Falls	93	31	63.4	0.59	
Viroqua	85	29	57.0	2.45	
Wakeeney (near)	.....	.....	.....	0.63	
Wallace	.....	.....	.....	T.	
Wamego*[1]	92	33	61.4	1.97	
Winfield	91	33	63.8	1.22	
Winona	.....	.....	.....	T.	
Yates Center	94	28	63.4	2.07	
Kentucky.					
Alpha*[3]	.....	37	59.1	2.83	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kentucky—Cont'd.	°	°	°	*Ins.*	*Ins.*
Bardstown	92	33	62.3	2.40	
Blandville	85	38	61.9	3.36	
Bowling Green	88	35	63.2	1.57	
Burnside	.....	.....	.....	2.83	
Canton*[1]	90	38	64.0	2.09	
Carrollton	86	36	60.9	1.95	
Catlettsburg	84	26	57.2	1.25	
Earlington	89	33	63.1	4.18	
Edmonton	82[c]	32[c]	60.8[c]	2.22	
Eubank	84	29	59.7	2.97	
Falmouth	.....	.....	.....	1.41	
Fords Ferry	90	30	61.8	2.66	
Frankfort	84[d]	40[d]	61.6[d]	1.48	
Georgetown	82	37	59.7	.....	
Greensburg	89	27	60.1	2.18	
Henderson	87	38	62.0	2.82	
Hopkinsville	93	38	64.0	2.68	
Irvington	88	34	62.2	3.38	
Leitchfield	88	31	61.5	2.04	
Loretto	90	30	59.3	2.82	
Marrowbone	85	29	60.3	2.00	
Maysville	90	31	59.2	2.08	
Middlesboro	83	31	59.0	2.09	
Mount Hermon	84	33	61.6	1.67	
Mount Sterling	82	32	59.0	2.49	
Owensboro	86	34	62.6	3.60	
Owenton	89	34	61.7	1.70	
Paducah *a*	.....	.....	.....	3.06	
Paducah *b*	92	41	65.0	3.11	
Princeton	92	35	62.6	3.08	
Richmond	86	29	61.3	3.33	
Russellville	87	35	62.4	1.48	
St. John	86	32	60.5	2.61	
Scott	87	29	58.7	1.53	
Shelby City	89	27	60.3	3.47	
Shelbyville	92	31	61.8	2.03	
Vanceburg	84	31	57.2	3.40	
Warfield	85	34	60.2	1.63	
Williamsburg	83	32	61.0	2.87	
Louisiana.					
Abbeville	88	43	71.5	2.75	
Alexandria	92	35	69.4	0.81	
Amite	92	38	70.4	0.31	
Bastrop	93	35	69.7	1.33	
Baton Rouge	89	45	70.7	1.77	
Calhoun	87	37	66.8	2.48	
Cheneyville	92	37	70.0	0.00	
Clinton	91	38	70.3	1.83	
Como	91	35	68.1	0.70	
Covington	91	39	69.5	0.30	
Donaldsonville	88	45	70.6	0.60	
Emilie	86	43	69.4	4.17	
Farmerville	89[1]	37[d]	68.3[d]	2.73	
Franklin	85	43	70.4	2.25	
Grand Coteau	89	42	70.8	1.26	
Hammond	91	39	70.8	1.27	
Houma	91	47	72.5	4.86	
Jeanerette	91	38	70.0	2.40	
Jennings	90	35	70.8	2.43	
Lafayette	90	40	70.4	2.57	
Lake Charles	91[b]	44°	72.8[f]	3.04	
Lake Providence	92	42	69.6	0.74	
L'Argent	92	38	71.2	1.42	
Lawrence	90	49	71.3	1.21	
Libertyhill	94	38	69.8	3.13	
Mansfield	93	33	67.6	1.51	
Melville	90	41	68.8	1.45	
Minden	92	34	68.6	1.62	
Monroe	94	41	69.0	1.09	
Montgomery	.....	35	.....	1.95	
New Iberia	86	43	70.5	2.60	
Oakridge	92	35	67.5	0.80	
Opelousas	90	40	69.4	3.29	
Paincourtville	88	43	70.4	2.48	
Plain Dealing	94	32	67.6	1.46	
Prevost	94	44	73.2	1.16	
Rayne	93	43	71.0	2.19	
Robeline*	92	31	67.4	3.10	
Ruston	92	37	69.3	2.48	
Schriever	92	41	69.0	3.51	
Shellbeach	88	44	67.8	2.49	
Southern University	91	46	70.4	3.52	
Sugar Ex. Station	85	47	70.4	2.03	
Sugartown	87	43	70.7	0.71	
Venice	85	52	72.2	1.13	
Wallace	90	42	70.2	1.73	
White Sulphur Springs	95	40	73.6	1.19	
Maine.					
Bar Harbor	76	28	49.0	3.05	T.
Belfast*[4]	72	33	49.1	3.03	T.
Calais	74	15	47.2	2.57	1.0
Cornish*[1]	73	26	49.7	2.84	
Fairfield	75	26	49.7	1.11	
Farmington	77	21	48.1	1.43	T.
Flagstaff	74	20	44.2	1.65	
Gardiner	76	28	50.4	1.85	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Maine—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lewiston	79	30	50.4	1.97	T.
Mayfield	73	21	46.4	1.71	T.
North Bridgton	80	28	50.7	1.56	
Orono	76	22	50.0	2.92	T.
Petit Menan*[1]	69	35	49.2	.....	
Rumford Falls	76	26	47.0	2.05	T.
Winslow	.....	.....	.....	1.34	
Maryland.					
Annapolis	77	29	59.4	4.50	
Bachmans Valley	77	25	54.8	2.32	
Boettcherville	84	22	56.6	1.28	
Boonsboro *a*	82	29	57.7	2.32	
Cambridge	76	37	60.1	3.97	
Charlotte Hall	83	27	58.9	4.39	
Chase	78	26	55.6	2.42	
Chestertown	78	32	58.0	2.60	
Chewsville	80	27	55.9	1.63	
Clearspring	78	22	54.5	.....	
Coleman	79	33	57.8	2.21	
Collegepark	79	28	56.9	1.35	
Cumberland	78	35	59.1	1.98	
Darlington	75	29	55.6	2.65	
Deerpark	80	15	50.8	0.39	
Easton	83	31	58.2	2.70	
Ellicott City	77	29	56.1	2.69	
Fallston	75	31	56.2	2.23	
Frederick	79	30	56.8	3.12	
Frostburg	79	29	56.8	1.45	
Grantsville	80	21	53.2	2.37	
Greatfalls	78	30	56.0	1.28	
Greenspring Furnace	78	26	55.1	1.70	
Hancock	84	25	56.2	2.49	
Harney	.....	.....	.....	2.11	
Jewell	88	31	58.0	5.07	
Johns Hopkins Hospital	79	33	57.0	2.21	
Laurel	79	29	57.1	5.30	
McDonogh	76	32	56.6	3.51	
Mardela Springs	79	29	59.8	3.89	
Mount St. Marys Coll.[2]	83	.....	54.8	3.02	
Newmarket	78	28	57.2	2.14	
Pocomoke City	80	31	60.6	4.73	
Port Deposit	80	30	57.0	2.85	
Princess Anne	81	28	59.2	4.33	
Queenstown	80	28	58.1	2.99	
Rockhall *b*	79	28	57.2	1.77	
Sandy Point	84	34	62.0	3.30	
Sharpsburg	77	31	56.2	1.40	
Smithsburg *b*	81	30	57.6	2.51	
Solomons	83	39	62.5	3.21	
Sudlersville	78	32	58.6	1.65	
Sunnyside	81	17	51.0	1.12	
Takoma Park	84	30	59.3	2.30	
Taneytown	79	27	56.0	1.97	
Van Bibber	75	31	56.0	4.06	
Wallbrook	77	32	57.3	.....	
Westernport	79	29	54.7	2.20	
Westminster	79	28	57.3	2.89	
Woodstock	83	30	57.3	2.94	
Massachusetts.					
Adams	77	21	51.8	.....	
Amherst	75	20	51.0	1.92	
Attleboro	.....	.....	.....	1.16	T.
Bedford	76	24	51.4	1.76	T.
Bluehill (summit)	73	28	51.7	2.69	
Cambridge	77	27	53.7	1.55	
Chestnuthill	76	26	53.5	2.81	
Cohasset	.....	.....	.....	2.27	
Concord	78	22	51.2	1.63	
Dudley[1]	75*	24	51.2	0.80	
East Templeton*[1]	74	29	49.3	1.13	T.
Fallriver	77	30	54.6	2.31	
Fiskdale	.....	.....	.....	2.31	T.
Fitchburg *a*[1]	74	31	50.8	1.93	
Fitchburg *b*	77	27	51.6	1.62	T.
Framingham	80	23	53.8	2.62	
Groton	76	23	50.8	2.30	T.
Hyannis*[1]	70	35	53.3	2.39	
Jefferson	.....	.....	.....	1.99	T.
Lawrence	77	28	52.8	1.99	T.
Leeds	77	23	51.6	2.41	
Leicester	75	23	50.8	1.36	T.
Leominster	.....	.....	.....	2.00	
Longplain	.....	.....	.....	1.62	
Lowell *a*	77	28	52.8	1.99	
Lowell *b*	79	25	51.8	.....	
Ludlow Center	78	18	48.1	2.97	
Middleboro	76	21	51.8	2.99	
Monson	77	20	51.8	1.84	
New Bedford *a*	75	30	55.4	3.51	
New Salem	79	25	51.2	1.96	T.
Pittsfield	74	22	50.8	1.56	
Plymouth*[1]	73	31	53.9	4.27	T.
Princeton	.....	.....	.....	2.80	
Salem	.....	.....	.....	2.41	
Somerset*[1]	78	24	53.0	3.08	
South Clinton	.....	.....	.....	2.65	

TABLE II.—*Climatological record of voluntary and other cooperating observers.*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Springfield Armory	76	25	53.2	2.93	
Sterling	.....	.....	.....	2.59	
Taunton *c*	76	22	52.0	3.50	
Webster	.....	.....	.....	1.13	
Westboro	78	21	54.2	2.41	
Weston	73	24	51.8	2.11	T.
Williamstown	74	22	50.4	1.11	T.
Winchendon	.....	.....	.....	1.62	T.
Worcester *b*	76	26	52.0	1.34	T.
Michigan.					
Adrian	84	21	54.2	2.74	
Agricultural College	83	28	53.2	2.68	
Allegan	.....	26*	.....	3.30	
Alma	82	21	53.8	2.76	
Ann Arbor	84	21	55.3	3.01	
Arbela	81	22	51.5	4.95	
Baldwin	80	15[b]	50.6[d]	3.38	
Ball Mountain	80	23	54.2	3.58	
Baraga	75	23	48.8	3.45	
Battlecreek	85	24	54.8	3.72	
Bay City	85	28	53.8	4.73	
Berlin	80	23	52.0	3.56	
Berrien Springs	88	28	56.6	3.38	
Big Point Sable *10	74	32	53.5	.....	
Big Rapids	79	19	52.0	2.10	
Birmingham	82	29	53.2	2.63	
Boon	76	18	49.4	2.76	T.
Calumet	68	28	47.0	1.75	T.
Carsonville	78	29	48.8	3.37	
Charlevoix	82	29	51.8	2.90	
Cheboygan	84	27	51.4	1.45	
Clinton	86	20	55.7	3.02	
Coldwater	85	22	56.0	3.93	
Eagle Harbor	73	28	48.5	1.68	
East Tawas	72	25	50.2	3.84	
Eloise	81	22	56.3	2.77	
Fairview	80	30	55.1	2.91	
Fitchburg	84	16	53.8	2.32	
Flint	81	20	54.2	3.02	
Frankfort	70	.....	.....	.....	
Gladwin	82	19	53.6	2.65	
Grand Rapids	85	27	55.9	2.92	
Grape	85	23	56.1	2.09	
Grayling	78	18	50.7	4.22	
Hanover	84	20	55.9	3.36	
Harbor Beach	79	34	52.8	3.09	
Harrison	78	21	52.2	4.23	
Harrisville	79	31	50.8	3.55	
Hart	81	26	53.6	2.37	
Hastings	86	20	53.8	3.42	
Hayes	84	26	49.8	3.19	
Highland Station	.....	.....	.....	3.10	
Hillsdale	82	20	55.0	3.24	
Holland *10	82	36	56.8	.....	
Howell	83	.....	.....	2.65	
Humboldt	77	17	43.6	4.06	
Ionia	81	21	53.1	1.65	
Iron Mountain	82	21	49.4	2.98	T.
Iron River	81	17	47.0	4.47	
Ishpeming	74*	22*	46.8*	3.98	
Ivan	76	20	50.8	1.82	
Jackson	84	23	55.6	3.13	
Jeddo	78	28	51.9	4.32	
Kalamazoo	85	26	55.9	3.44	
Lake City	79	24	51.9	.....	
Lansing	85	26	53.9	3.11	
Lapeer	80	22	52.9	3.49	
Lathrop	76	15	46.2	3.70	T.
Lincoln	79	28	50.7	1.53	
Ludington	76[d]	20	51.4	0.81	
Luzerne	78	20	49.8	3.27	
Mackinaw	82	30	50.1	1.99	
Madison	83	22	55.4	2.46	
Mancelona	77	11	50.2	3.53	
Menominee	75	27	50.6	1.36	
Middle Island *10	74	37	51.4	.....	
Mottville	86	23	55.0	5.16	
Mount Clemens	80	24	53.1	2.31	
Mount Pleasant	82	22	51.8	2.49	
Muskegon	86	27	54.4	1.20	
Newberry	70	20	46.2	1.67	
North Manitou Island *10	75	32	52.3	.....	
Northport	77	31	52.6	2.85	
Old Mission	78	26	53.7	3.04	
Olivet	80	25	54.1	2.81	
Omer	80	.....	.....	3.35	
Ovid	85	23	53.8	2.56	
Owosso	85	22	54.2	3.15	
Petoskey	80	25	50.2	1.98	
Plymouth	82	30	53.8	3.40	
Port Austin	82	25	52.9	2.83	
Reed City	79	15	51.4	3.96	
Rogers	85	28	50.0	1.94	
Romeo	80	27	53.6	3.37	
Saginaw	84	24	54.4	3.46	
St. Ignace	69	27	45.3	1.93	
St. Johns	84	24	55.0	2.76	
St. Joseph	85	30	55.6	2.49	
Sidnaw	73	22	44.8	.....	
Somerset	83	21	55.1	3.49	
South Haven	84	29	57.1	2.08	
Thornville	80	27	53.6	3.16	
Traverse City	79	30	53.6	1.96	
Vandalia	85	28	55.8	3.87	
Vassar	83	21	53.2	5.25	
Vermilion *10	70	26	45.6	.....	
Wasepi	84	24	55.3	4.16	
Waverly	85	25	54.2	2.45	
Wetmore	77*	22*	47.4*	2.43	
Whitecloud	85	18	52.4	1.58	
Ypsilanti	81	22	53.6	3.18	
Minnesota.					
Ada *c*	72	22	44.6	0.88	
Albert Lea	84	28	53.3	2.50	
Alexandria	73	28	47.2	2.29	0.5
Ashby	72	27	46.8	2.43	T.
Beardsley	76	24	47.2	2.98	
Bird Island	82	28	50.7	2.46	0.8
Blooming Prairie	83	25	51.4	2.35	T.
Brainerd	70	25	46.4	3.81	
Caledonia	81	28	52.8	1.23	
Camden	83	26	50.4	2.86	1.0
Collegeville	75	30	49.2	4.73	T.
Crookston	69	23	45.0	2.05	
Deephaven	.....	.....	.....	3.14	
Detroit City	70	23	44.1	2.11	1.0
Faribault	82	29	51.3	4.76	
Farmington	82	26	50.6	3.46	T.
Fergus Falls	67	26	46.2	1.67	0.2
Glencoe	80	24	48.4	4.35	T.
Grand Meadow	84	28	50.9	1.15	T.
Hallock	73	16	42.5	1.22	0.5
Lake City	87	28	53.0	4.01	
Lake Jennie	80	30	52.7	2.73	
Lakeside	80	28	49.0	2.22	T.
Lake Winnibigoshish[1]	69	26*	45.9	2.82	
Leech	71	24	45.2	1.93	
Leroy	84	25	53.4	1.42	
Long Prairie	72	25	45.9	5.41	
Luverne	81	27	50.9	4.11	
Lynd	82	25	48.7	4.07	1.0
Mapleplain *1	81	30	49.8	2.93	0.3
Milaca	77	21	45.8	7.83	
Milan	81*	26*	48.3*	3.50	0.8
Minneapolis *a*	80	27	49.8	2.54	T.
Minneapolis *b*[1]	81*	25	49.2	3.34	0.1
Minnesota City *1	84	26	53.4	1.05	
Montevideo	78	27	48.6	4.55	0.5
Morris	74	28	48.0	1.67	2.0
Mount Iron	69	21	44.8	3.77	T.
Newfolden	70	11	42.6	2.27	0.1
New London	79	22	47.6	5.78	1.0
New Richland *1	80	30	52.9	.....	
New Ulm	82	23	50.6	2.50	T.
Park Rapids	67	24	44.8	2.78	
Pine River	72	24	45.8	3.99	
Pipestone	79	21	49.2	3.52	
Pleasant Mounds	85	30	53.5	4.62	
Pokegama Falls	71	18	44.2	3.45	
Redwing	.....	.....	.....	4.20	
Reeds	.....	.....	.....	3.47	
Rolling Green	83	31	51.9	2.91	
St. Charles	85	27	51.6	1.40	T.
St. Cloud	79	29	48.8	7.95	
St. Peter	84	31	52.4	3.48	T.
Sandy Lake Dam	71	28	45.8	3.78	
Shakopee	82	27	52.0	4.22	
Tower	70	21	43.1	3.20	T.
Two Harbors	79	25	47.2	4.72	
Wabasha *1	85	27	52.3	2.24	
Willmar	78	30	48.2	4.27	1.0
Willow River	75[1]	22	46.8*	4.42	
Winnebago City	84	26	52.4	3.59	
Worthington	80	28	51.3	2.91	
Zumbrota[1]	84*	25	52.4	.....	
Mississippi.					
Aberdeen	85	35	63.2	0.80	
Agricultural College	87	42	67.6	1.10	
Americus	91	46	70.8	1.77	
Austin	88	35	64.6	1.16	
Batesville	88	34	64.7	1.60	
Bay St. Louis	89	52	70.3	1.33	
Biloxi	90	41	66.8	0.80	
Booneville	87	41	66.7	1.22	
Brookhaven	94	39	70.2	0.27	
Canton	93	37	68.4	0.78	
Columbus *a*	.....	.....	.....	2.34	
Columbus *b*	86	40	66.4	2.28	
Crystalsprings	94	41	69.8	0.55	
Edwards	91	42	69.6	0.64	
Fayette	91	39	69.4	1.50	
Fayette (near) *1	89	44	70.1	.....	
Greenville *a*	84	45	67.0	1.09	
Greenville *b*	89	45	68.6	1.15	
Greenwood	89	40	69.2	1.13	
Hattiesburg	86	44	68.7	0.58	
Hazlehurst	94	41	70.4	0.75	
Hernando	85	40	66.2	0.37	
Holly Springs	85	40	65.4	2.24	
Jackson	95	42	70.8	.....	
Lake	89	36	64.9	0.95	
Leakesville	94	36	68.4	1.11	
Logtown	90	45	69.0	1.77	
Louisville	90	35	67.1	0.99	
Macon	89	34	65.7	0.70	
Magnolia	90	39	69.8	0.63	
Natchez	92	43	71.5	1.15	
Okolona	86	36	63.6	1.32	
Palo Alto	88	41	67.8	1.69	
Pontotoc	88	38	67.0	0.82	
Port Gibson	96	36	69.0	0.85	
Ripley	87	37	64.9	2.42	
Stonington *1	88	40	70.0	.....	
Thornton	.....	.....	.....	0.60	
Tupelo	.....	.....	.....	1.32	
University	89	38	67.0	2.01	
Walnutgrove	89[b]	41[b]	70.4[b]	0.60	
Watervalley *1	88	41	66.2	1.40	
Waynesboro	87	40	67.8	1.25	
Windham	92	40	67.6	0.51	
Woodville	87	40	69.4	2.04	
Yazoo City	93	35	68.4	0.77	
Missouri.					
Appleton City	100	35	65.5	3.19	
Arthur *3	.....	35	60.2	2.74	
Avalon	96	31	62.4	1.43	
Bethany	92	26	59.5	1.83	
Birchtree	86	32	61.8	2.68	
Boonville	.....	.....	.....	2.58	
Brunswick	93	26	60.6	2.10	
Carrollton	.....	.....	.....	1.27	
Conception	88	36	61.7	1.86	
Cook Station	93	26	61.8	5.10	
Cowgill *5	90	34	63.5	0.85	
Darksville	92	36	61.0	1.55	
Downing	.....	.....	.....	1.08	
East Lynne *3	98	32	60.8	2.38	
Edgehill *5	82	28	58.2	3.30	
Edwards	95	30	64.0	4.18	
Eightmile *1	90	34	62.2	2.50	
Eldon	95	29	62.8	3.47	
Elmira	94	24	62.2	0.94	
Fairport	.....	.....	.....	0.97	
Fayette	93	32	62.6	2.12	
Fulton	.....	.....	.....	3.00	
Galena	.....	.....	.....	5.69	
Gallatin *1	92	32	62.6	1.00	
Gayoso	87	32	62.4	3.28	
Glasgow	96	30	63.0	2.19	
Gorin	.....	.....	.....	1.12	
Halfway	92	29	63.9	3.70	
Harrisonville	95	33	62.4	2.08	
Hazlehurst	.....	.....	.....	0.62	
Hermann	.....	.....	.....	5.45	
Houston	90	29	61.6	4.22	
Houstonia (near)	.....	.....	.....	2.66	
Irena	.....	.....	.....	1.99	
Ironton	93	27	61.1	3.82	
Jackson *3	92	37	59.4	4.37	
Jefferson City	93	31	65.2	3.30	
Kidder	94	31	62.4	1.05	
Lamar	96	33	65.4	3.80	
Lamonte	.....	.....	.....	2.67	
Lebanon	91	34	64.0	5.27	
Lexington	96	32	64.2	1.07	
Liberty	93	30	62.7	0.47	
Louisiana	95	29	62.0	3.34	
McCune *1	93	33	61.0	3.02	
Macon	94	32	63.1	1.66	
Marblehill	91	29*	61.2	4.49	
Marshall	95	29	62.2	1.86	
Maryville	90	34	59.6	4.19	
Mexico	95	32	62.9	2.66	
Miami *5	91	35	62.4	2.42	
Mineralspring	91*	28*	61.9*	6.11	
Montreal	92	29	62.8	4.66	
Mount Vernon	95	32	67.6	4.67	
Neosho	92	31	63.2	4.24	
Nevada	92	31	64.8	2.27	
New Haven	93	33	62.8	5.36	
New Madrid	86	38	63.1	6.33	
New Palestine	96	31	63.2	2.52	
Oakfield	93	34	64.2	4.60	
Olden	90	29	60.6	2.26	
Oregon *a*	92	36	62.5	1.80	
Oregon *b*	93	38	65.2	1.70	
Palmyra *5	90	32	61.6	2.00	
Phillipsburg *1	93	32	61.9	5.24	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pickering *3	91	28	56.2	3.00	
Poplarbluff	90	34	63.8	3.33	
Potosi	87	27	56.0	3.11	
Princeton	90	28	61.0	1.28	
Rhineland	93	30	62.6	4.04	
Richmond	93	32	63.4	0.95	
Rolla				4.57	
St. Charles	90	33	62.2	4.67	
St. Joseph				0.55	
Sarcoxie *3		32	59.2	4.13	
Sedalia	95	29	64.2	2.55	
Seymour	90	31	61.5	5.16	
Shelbina				3.10	
Sikeston	90	34	62.5	5.06	
Steffenville	94	31	61.6	2.06	
Stellada	95	34	63.6	3.19	
Sublett	92	28	61.0	1.00	
Trenton	90	30	60.6	0.74	
Unionville	90	32	61.6	1.08	
Vichy	95	34	64.4	5.33	
Warrensburg	94	33	63.8	2.53	
Warrenton	92	33	61.4	5.22	
Wheatland				4.15	
Willowsprings	99	30	64 7	2.64	
Wylie	94	31	64.6	4.36	
Zeitonia	92	29	61.3	1.35	
Montana.					
Boulder	72	5	38.0	0.90	T.
Butte	71	17	41.0	1.65	
Canyon Ferry	74	14	41.0	0.85	2.0
Chinook	82	10	40.2	0.51	2.0
Corvallis	78	10	47.6		
Crow Agency	81	21	44.7	1.37	3.4
Dearborn Canyon	75	— 2	38.5	3.60	35.0
Deerlodge	80	5	41.3		
Dell	74	4	35.0	1.23	12.3
Ekalaka	81	21	43.3	1.18	7.1
Fort Benton	87	12	45.0	0.70	7.0
Fort Keogh	85	25	43.8	3.80	
Fort Logan	70	— 3	38.4	1.71	10.0
Glasgow	85	16	41.0	1.64	
Glendive	85	24	44.6	1.80	4.0
Glenwood	69	8	38.3	1.99	
Greatfalls	78	11	43.6	0.91	4.8
Kipp	75	— 9	35.8	3.29	32.5
Manhattan	76	12	39.1	1.05	3.0
Martinsdale	75	3	39.8	1.50	4.0
Marysville	74	2	36.4	2.39	16.8
Missoula	75	18	43.7	1.02	T.
Ovando	73	8	39.6	1.74	3.6
Parrot	73°	12°	41.2°	2.24	4.0
Plains	73	16	43.2	0.60	
Poplar	82	20	41.4	0.73	4.0
Red Lodge	80	10	44.4		
Ridge	80	21	43.3	1.36	3.0
St. Pauls	82	12	39.9	1.55	12.0
Troy	74	18	44.6	1.96	T.
Utica	80	4	40.7	1.15	8.2
Yale	79	12	39.0	1.04	3.0
Nebraska.					
Agee				0.59	
Albion	87°	19	54.4°	0.84	
Alliance				0.50	
Alma	94	22	58.4	0.40	
Ansley	92	19	52.7	0.44	
Arapaho *1	90	26	53.0	0.00	
Arborville *1	92	28	60.2	0.95	
Ashland *a*	94	31	59.6	2.47	
Ashland *b* *1	92	35	57.8	2.44	
Ashton				0.28	
Auburn	95	31	61.8	4.32	
Aurora *1	92	29	54.7	1.00	
Bartley				T.	
Beatrice	92	28	59.4	3.35	
Beaver City	98	22	57.1	0.02	
Bellevue				3.23	
Benedict				0.93	
Benkleman				T.	
Blair	93	32	57.0	1.62	
Bluehill				0.77	
Bradshaw				1.81	
Brokenbow				0.42	
Burchard				3.12	
Burwell				0.00	
Callaway	95	11	50.2	0.45	
Camp Clarke	91	23	48.3	0.74	
Central City				0.00	
Chester				3.65	
Clatonia	93	31	63.4	3.80	
Columbus	89	27	55.5	0.95	
Creighton	86	18	51.8	0.40	
Crete	94	30	59.0	2.98	
Culbertson				0.23	
Curtis *a*	95	20	52.8	0.15	
David City	90	25	53.7	2.05	
Dawson	96	34	63.6	3.54	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Eden				4.90	
Edgar *a*				1.57	
Elba				0.20	
Ericson *1	85	22	47.8	0.20	
Ewing				0.57	
Fairbury	92	27	60.4	3.66	
Fairfield	91	30	59.0	1.30	
Fairmont	92	31	58.6	3.12	
Fort Robinson	80	15	43.8	1.70	5.0
Fremont	93	27	57.6	0.78	
Geneva	91	26	55.8	2.92	
Genoa	90	28	55.9	0.81	
Gering	91	11	45.2	1.19	
Gordon				0.80	
Gothenburg	94	19	51.8	0.50	
Grand Island *a*				0.49	
Grand Island *b*	93	25	56.8	1.11	
Grand Island *c*	91	23	55.4	0.66	
Greeley				1.00	
Haigler				0.00	
Hartington	86	26	53.2	1.45	
Harvard	89	29	57.2	1.33	
Hastings *1	88	31	55.7	0.46	
Hayes Center				T.	
Hay Springs	90	24	46.9	0.78	
Hebron	93	30	59.8	3.30	
Hickman				3.25	
Hooper *1	90	30	55.7	0.92	
Imperial	95	18	50.6	0.19	
Johnstown				T.	
Kearney				0.45	
Kennedy	94	17	48.2	0.30	
Kimball	91	16	46.2	0.58	T.
Kirkwood *1	90	33	49.0	1.69	
Lexington	90	16	53.5	0.11	
Lincoln *d*	94	34	60.2	2.60	
Lodgepole	90	20	47.8	T.	
Loup *1	86	20	51.6	0.00	
Lynch	90	18	53.2	0.76	
Lyons				0.89	
McCook				T.	
McCool				1.81	
Madison	89	27	54.9	1.13	
Madrid				0.14	
Marquette				0.84	
Merriman				0.00	
Minden *a*	93	25	57.4	0.45	
Minden *b*				0.45	
Monroe				0.62	
Nebraska City *b*				3.40	
Nebraska City *c*	94	35	60.6	3.61	
Nemaha *1	94	34	57.7	4.35	
Nesbit	90	20	48.8	0.42	
Norfolk *b*	88	22	53.8	0.95	
North Loup	92	21	55.3	0.20	
Oakdale	89	23	52.6	0.88	
Odell				3.95	
O'Neill	90	20	51.1	0.33	
Ord				0.20	
Osceola				0.42	
Ough				0.00	
Palmer *b* *1	72	26	55.8	0.12	
Palmyra				3.39	
Plattsmouth *b*				3.99	
Pleasanthill				3.20	
Ravenna *a*	92	21	54.2	0.58	
Redcloud *a*				1.66	
Redcloud *b*				1.88	
Republican				0.30	
Rulo				1.75	
St. Libory				0.40	
St. Paul				0.78	
Salem *1	88	40	59.6	2.55	
Santee	89	23	53.1	0.49	
Sargent				0.20	
Schuyler				1.75	
Seneca				0.00	
Seward *1	90	34	58.4	2.12	
Smithfield				0.00	
Spragg				1.25	
Springview	83	24	49.3	0.09	
Stanton *1	84	25	52.8	1.93	
State Farm	95	30	59.8	2.51	
Strang				3.63	
Stratton				0.07	
Superior *5	80	34	61.1	3.90	
Syracuse				4.12	
Tablerock				3.57	
Tecumseh *b*	98	33	60.0	3.62	
Tecumseh *c*				3.82	
Tekamah	93	29	57.5	0.97	
Thedford				0.11	
Turlington	94	35	60.2	4.05	
Valentine	94	21	49.6	0.98	
Valparaiso				1.64	
Wakefield	90	25	54.2	1.84	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wallace				0.15	
Wauneta				0.00	
Weeping Water *1	90	28	54.1	3.14	
Wellfleet				0.80	
Westpoint	90	27	58.6	1.53	
Whitman				T.	
Wilber *1	90	32	58.6	3.11	
Willard				0.37	
Wilsonville *1	92	23	54.2	0.00	
Wisner				1.47	
Wymore *1	87	30	54.4	4.18	
York *1	90	32	55.0	1.31	
Nevada.					
Battle Mountain *1	72	22	44.2	T.	T.
Beowawe *1	75	21	48.1	T.	T.
Candelaria	81	19	49.6	0.35	0.5
Carlin				0.87	
Carson City	80	30	46.2	0.85	7.4
Clover Valley				1.14	6.0
Cranes Ranch				1.10	
Elko *1	73	22	41.3	0.40	1.0
Elko (near)	78	15	47.0	0.75	1.5
Ely	75	13	41.0	2.08	15.0
Empire Ranch	83	12	44.2	0.55	5.5
Fenelon				0.30	3.0
Golconda *1	68	28	46.0	0.20	2.0
Halleck *1	83	16	39.1	0.50	5.0
Hawthorne *b*	78	21	50.2	0.09	T.
Hot Springs				0.00	
Humboldt *1	75	27	47.0	1.10	11.0
Lee				1.64	14.2
Lewers Ranch	78	17	46.2	2.45	14.5
Los Vegas	83	31	55.6	0.28	
Lovelocks *1	80	31	47.1	0.30	0.2
Martins	77	20	46.8	0.35	3.5
Mill City *1	80	25	46.7	0.60	5.0
Palisade *1	77	25	45.8	1.00	0.5
Palmetto	81	13	42.1	1.05	8.0
Reno State University	78	22	47.4	0.72	6.8
Silverpeak	89	23	52.6	T.	
Sodaville	88	20	48.8	T.	
Tecoma *1	75	20	38.2	0.50	T.
Toano *1	78	26	44.6	0.40	4.0
Tuscarora	70	18	42.0	1.24	1.0
Tybo	78	17	44.1	0.57	8.0
Verdi *1	86	24	48.8	2.10	6.0
Wadsworth *1	80	22	44.9	0.20	T.
Wells	72	10	41.2		
New Hampshire.					
Alstead *6	70	21	49.8	2.03	T.
Berlin Mills	82	20	48.0	1.73	
Bethlehem	74	21	47.6	2.81	1.0
Brookline *1	78	20	50.4	1.51	T.
Claremont	80	20	50.2	0.85	T.
Concord	77	22	49.4	0.83	T.
Durham	77	27	50.4	2.15	
Grafton	80	14	47.0	1.08	T.
Hanover	79	20	50.0	1.60	T.
Keene	79	17	50.0	1.23	T.
Littleton	74	23	47.6	2.63	T.
Nashua	77	22	51.2	1.92	T.
Newton	76	21	50.0	1.98	T.
North Conway	80	20	49.3	1.90	
Peterboro	78	18	48.9	2.09	T.
Plymouth	79	24	48.0	1.78	T.
Sanbornton	79	21	49.4	1.51	T.
Stratford	78	17	49.0	1.57	T.
Warner				1.63	T.
New Jersey.					
Asbury Park	80	31	57.5	3.06	
Bayonne	83	30	58.0	1.84	
Belvidere	84	18	52.9	1.43	
Bergen Point	79	34	57.6	2.32	
Beverly	84	28	57.6	2.51	
Billingsport *1	75	35	56.9	4.02	
Boonton	81	21	54.4	1.07	
Bridgeton	83	29	58.4	2.95	
Camden	76	32	56.6	2.85	
Cape May C. H.	79	28	58.8	4.62	
Charlotteburg	81	19	53.0	2.76	
Chester	80	25	54.0	2.44	
Clayton	82	27	57.6	2.27	
College Farm	81	27	57.0	2.96	
Deckertown	79	21	54.3	1.84	
Dover	81	22	54.0	1.77	
Egg Harbor City	78	26	57.0	4.46	
Elizabeth	81	27	56.9	2.58	
Englewood	79	23	54.8	2.65	
Flemington	82	25	56.4	1.75	
Freehold	75	28	55.6	3.28	
Friesburg	86	27	58.2	1.99	
Hammonton				3.48	
Hanover	75	23	54.7	1.76	
Hightstown	77	29	57.2	2.77	
Imlaystown	80	29	58.8	3.56	
Lambertville	81	25	56.0	2.11	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lebanon	.....	.....	.....	2.38	
Moorestown	80	29	57.0	3.00	
Mount Pleasant	.....	.....	.....	3.72	
Newark	81	29	56.0	2.54	
New Brunswick	82	26	58.3	3.56	
Newton	82	21	54.0	1.56	
Ocean City	80	29	57.0	4.43	
Oceanic	77	32	56.4	3.48	
Paterson	84	28	58.2	2.28	
Perth Amboy	78	30	56.1	2.55	
Plainfield	80	24	55.3	2.91	
Rancocas	.....	.....	.....	2.25	
Rivervale	81	19	54.6	1.42	
Rocktown	.....	.....	.....	1.27	
Roseland	83	21	54.6	1.67	
Salem	82	29	58.0	2.09	
Somerville	82	23	56.7	1.52	
South Orange	77	29	55.6	2.45	
Staffordville	.....	.....	.....	4.29	
Toms River	82	23	56.5	4.11	
Trenton	80	28	59.3	1.59	
Tuckerton	79	29	57.0	4.37	
Vineland	80	27	58.6	3.53	
Woodbine	78	28	57.9	4.65	
New Mexico.					
Albert	85	35	58.4	0.39	
Albuquerque	80	26	56.2	T.	
Alma	84	22	54.9	0.69	
Aztec	83	21	50.9	0.94	T.
Bellranch	.....	.....	.....	0.20	
Bernalillo	86	26	56.2	T.	
Bluewater	79	15	48.1	0.65	T.
Cambray	.....	.....	.....	0.00	
Clayton	76	16	52.2	0.40	
Deming	.....	.....	.....	T.	
East Lasvegas	78	19	49.3	0.52	1.4
Engle	85	25	57.2	0.50	
Espanola	84	19	52.0	0.22	
Folsom	79	19	49.2	1.83	6.7
Fort Bayard	84	25	54.7	0.90	
Fort Union	82	25	53.4	0.60	2.0
Fort Wingate	83	20	51.9	0.85	T.
Gage	.....	.....	.....	0.10	
Gallisteo	79	21	50.6	0.00	
Gallinas Spring	81	20	53.3	0.33	
Gila	88	28	58.6	1.00	
Hillsboro	76	30	54.4	0.00	
Las Vegas Hotsprings	77	22	51.0	0.35	T.
Lordsburg	.....	.....	.....	0.00	
Los Lunas	74	26	51.4	T.	
Lower Penasco	78	30	56.2	1.15	
Monero	72	7	42.0	2.30	7.0
Raton	80	22	53.0	0.25	1.0
Rincon	86	32	61.8	0.00	
Roswell	86	28	59.8	0.20	
San Marcial	86	24	56.2	0.45	
Shattucks Ranch	83	25	56.6	0.50	
Socorro	85	27	56.9	0.18	
Strauss	.....	.....	.....	T.	
Whiteoaks	78	25	53.8	T.	
Winsors Ranch	75	11	41.6	1.08	
New York.					
Adams	.....	.....	.....	4.19	
Addison	81	23	52.8	1.93	
Akron	.....	.....	.....	3.44	
Alfred	81	21	53.9	1.34[b]	
Angelica	80	21	51.7	2.99	
Appleton	80	28	53.0	2.91	
Arcade	79	25	52.2	3.07	
Atlanta	.....	.....	.....	1.91	
Auburn	85	25	55.4	2.66	
Avon	83	23	52.0	2.04	
Axton	79	17	49.4	2.85	T.
Baldwinsville	82	27	53.4	3.08	T.
Bedford *a*	80	20	54.0	1.41	
Big Sandy [10]	76	25	51.7	.....	
Bolivar	81	17	50.0	2.27	T.
Bouckville	74	20	51.4	3.53	
Boyds Corners	.....	.....	.....	1.49	
Brentwood	82	23	55.8	3.70	
Caldwell	76[b]	32[b]	51.4[b]	3.20	T.
Canajoharie	79	20	51.1	1.76	
Canton	78	21	50.4	2.61	
Carmel	80	32	55.1	1.02	
Carvers Falls	78	21	49.6	2.02	T.
Catskill	75[d]	25	52.8	1.92	
Cedarhill	86	23	54.4	1.03	T.
Charlotte [10]	79	26	52.3	.....	
Chenango Forks	.....	.....	.....	1.75	
Cherrycreek	.....	.....	.....	2.47	
Cooperstown	74	20	50.7	2.25	T.
Cortland	81	19	52.5	2.99	
Cutchogue	72	32	54.4	2.54	
Dekalb Junction	.....	.....	.....	2.61	
Dryden	80	18	51.4	2.69	T.
Easton	.....	.....	.....	1.44	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Elmira	77	20	54.0	3.07	
Fayetteville	.....	.....	.....	2.27	
Fleming	84	28	55.8	2.13	T.
Fort Niagara	78	29	53.2	3.20	
Franklinville	82	20	51 4	2.40	T.
Fulton	.....	.....	.....	2.83	
Garrattsville	77	14	51.2	.....	
Glens Falls	75	26	51.4	1.67	T.
Gloversville	78	20	50.2	2.15	
Greenwich	74	22	51.1	1.46	T.
Haskinville	.....	.....	.....	2.15	
Hemlock	80	26	52.2	1.96	
Honeymead Brook	75	21	51.6	0.35	
Humphrey	82	26	54.0	2.86	
Indian Lake	81	18	48.6	2.50	T.
Ithaca	82	23	54.1	2.34	T.
Jamestown	80	29	54.1	2.30	
Keene Valley	78	19	49.0	1.99	
King Station	.....	.....	.....	1.97	
Lakehill	75	22	51.3	1.30	
Liberty	77	28	52.6	3.14	
Littlefalls	80	23	50.9	2.12	
Lockport	78	28	52.4	1.71	
Lowville	80	20	50.5	3.15	
Lyndonville	.....	.....	.....	2.80	
Lyons	80[a]	29[b]	53.7[c]	1.78	
Madison Barracks	81	20	50.0	1.85	
Mayle	.....	.....	.....	3.67	
Middletown	75	27	53.2	0.84	
Mount Morris	84	20	53.2	0.24	
Newark Valley	.....	.....	.....	1.60	
New Lisbon	77	13	49.0	1.70	T.
North Germantown	78	28	53.1	1.91	
North Hammond	76	26	52.4	2.69	
North Lake	75	20	47.8	4.48	
Number Four	76	19	49.1	2.91	T.
Nunda	84	24	53.5	2.09	
Ogdensburg	77	27	51.4	2.62	
Oneonta	78	18	50.4	1.77	
Oxford	78	18	50.8	2.52	T.
Palermo	80	21	51.2	1.87	
Penn Yan	85	24	54.4	2.17	T.
Perry City	78	19	50.6	3.22	
Phenix	.....	.....	.....	2.76	
Pine City	.....	.....	.....	2.20	
Plattsburg Barracks	72	29	50.6	2.15	T.
Port Byron	79	26	52.4	2.08	T.
Port Jervis	77	20	53.2	1.00	
Poughkeepsie	78	20	51.6	0.82	
Primrose	80	23	54.2	2.42	
Richmondville	.....	.....	.....	1.15	T.
Ridgeway	80	29	53.4	2.35	
Rome	80	20	51.3	2.17	
Romulus	82	27	54.7	1.47	
Rose	.....	.....	.....	2.67	
St. Johnsville	79	21	51.4	1.94	
Saranac Lake	77°	24°	49.2°	2.85	T.
Saratoga Springs	74	24	51.8	2.23	0.1
Scottsville	.....	.....	.....	2.03	
Setauket	75	36	56.4	2.75	
Sherwood	.....	.....	.....	3.56	
Shortsville	83	21	53.0	2.12	
Skaneateles	.....	.....	.....	2.90	
South Canisteo	80	21	51.2	3.21	
Southeast Reservoir	.....	.....	.....	1.39	
South Kortright	77	14	49.4	0.90	
Straits Corners	79	17[d]	52.2	1.87	T.
Volusia	80	29	54.5	2.45	
Wappingers Falls	75	25	54.0	2.00	
Warwick	.....	.....	.....	1.74	
Watertown	80	22	52.0	3.28	
Waverly	83	17	52.4	1.53	T.
Wedgwood	85	23	54.0	2.62	
West Chazy	76	25	49.5	.....	
Westfield *a*	81	31	55.0	2.61	
Westfield *b*	80	31	55.2	2.33	
Westfield *c*	80	34	56.7	2.39	
Westpoint	76	26	54.4	1.64	
Willetspoint	78	36	58.1	1.85	
Williamson	.....	.....	.....	2.71	
North Carolina.					
Abshers	84	27	60.4	2.07	
Asheville	.....	.....	.....	1.39	
Biltmore	83	28	57.2	1.01	
Bryson City	.....	.....	.....	2.97	
Chapelhill	84	36	61.5	5.96	
Cherryville	87	35	62.6	2.44	
Currituck	.....	.....	.....	3.57	
Durham [11]	81	38	59.8	7.30	
Edenton	81	40	64.3	6.40	
Fairbluff	.....	.....	.....	4.38	
Fayetteville	87	38	63.2	3.81	
Flatrock	78[d]	23[d]	51.5[d]	2.49	
Goldsboro	83	38	61.8	4.36	
Greensboro	81	36	59.2	3.14	
Henderson	82	34	61.1	5.72	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hendersonville	80	27	57.0	2.38	
Horse Cove	79	34	56.9	4.15	
Kinston	87	37	63.2	3.34	
Lenoir [11]	77	36	58.8	1.62	
Linville	69	22	50.2	2.00	
Littleton	82	33	59.4	5.35	
Louisburg	81	35	61.0	4.80	
Lumberton	82	41	62.3	6.08	
Mana	.....	.....	.....	2.68	
Marion	88	30	60.0	2.00	
Marshall	79	28	56.6	1.63	
Mocksville	89	35	64.6	2.69	
Moncure	81	37	61.6	4.98	
Monroe	84	28	60.0	7.10	
Morganton	87	32	61.8	1.45	
Mountairy	79	28	57.8	2.26	
Mount Pleasant	84	34	62.0	4.16	
Murphy	.....	.....	.....	2.23	
Newbern	89	40	64.6	3.50	
Oakridge	85	29	59.3	2.14	
Pantego	.....	.....	.....	5.78	
Patterson [11]	80	29	59.4	1.20	
Pittsboro	85	31	60.0	6.39	
Rockingham	86	36	62.2	8.55	
Roxboro	.....	.....	.....	6.03	
Salem	80	30	59.0	3.02	
Salisbury	84	34	61.2	3.10	
Saxon	80	28	58.8	2.36	
Settle	80	28	57.1	2.55	
Sloan	87	40	64.8	2.96	
Soapstone Mount	82	28	58.6	5.79	
Southern Pines *a*	88	35	63.7	7.78	
Southern Pines *b*	83	38	64.6	8.03	
Southport	86	45	68.0	5.91	
Springhope [11]	75	39	59.5	5.65	
Tarboro	89°	34°	63.1°	6.49	
Waynesville	78	25	55.2	2.89	
Weldon *a*	78	38	60.0	5.25	
Weldon *b*	.....	.....	.....	5.46	
North Dakota.					
Amenia	74	24	44.0	1.53	T.
Ashley	77°	18°	41.1°	0.71	0.4
Berlin	75	18	42 8	1.53	3.0
Buxton	70	20	43.2	1.16	
Churchs Ferry	81	13	40.4	1.68	T.
Coalharbor	84	21	42.2	1.38	
Devils Lake	80	20	41.4	1.97	
Dickinson	82	23	42.5	1.43	1.7
Dunseith	81	10	39.4	1.14	
Ellendale	78	21	45.4	0.73	0.3
Fargo	73	21	43.7	1.67	
Forman	75	18	44.2	0.67	2.0
Fort Berthold	74	24	41.0	1.44	7.0
Fort Yates	85	18	45.2	0.80	
Fullerton [1]	75*	19	42.0	1.21	1.6
Gallatin	75	13	42.2	0.90	T.
Glenullin	85	12	40.7	0.96	0.5
Grafton	67°	16°	40.1°	T.	T.
Hamilton	73	14	41.9	1.40	3.2
Hannaford	76	19	42.9	0.75	
Kelso	72	22	43.2	.....	
Larimore	78	17	43.2	0.82	
McKinney	85	9	38.5	2.30	6.0
Mayville	72	25	44.6	1.10	
Medora	81	14	42.0	0.92	2.0
Melville	80	23°	44.0	1.10	
Milton	70	17	38.6	1.75	2.0
Minnewaukon	81	18	41.4	1.23	T.
Minot	86	22	42.8	1.35	2.0
Minto	78	11	42.1	1.07	.....
Napoleon	78	19	42.6	0.76	1.5
Oakdale	72	20	41.3	0.97	0.5
Pembina	75	16	41.2	1.17	T.
Portal *	64	13	36.6	0.80	8.0
Power	74	16	44.2	0.96	
St. John	77	12	40.0	1.78	0.2
Sheyenne	63[a]	20[i]	39.5[h]	1.19	T.
Towner	82	16	39.6	2.10	2.0
University	72	22	44.2	1.55	T.
Wahpeton	74	25	47.4	1.57	0.7
Willow City	84	10	39.4	1.20	6.0
Woodbridge	68	7	38.3	0.30	1.0
Ohio.					
Akron	84	29	57.0	2.73	
Ashland	86	23	58.6	2.63	
Ashtabula	82	30	56.2	2.30	
Atwater	.....	.....	.....	1.97	
Bangorville	88	25	57.4	2.59	
Bellefontaine	85	30	59.8	1.87	
Benton Ridge	87	23	56.8	1.74	
Bethany	87	30	59.8	2.26	
Bigprairie	87	28	57.9	2.26	
Binola	.....	.....	.....	2.48	
Bloomingburg	88	27	59.0	1.77	
Bowling Green	88	22	57.2	2.47	
Cambridge	84	26	56.2	2.21	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Camp Dennison	87	27	59.0	1.84	
Canal Dover	83	23	54.5	1.65	
Canton	82	26	56.0	1.83	
Cedarville				1.99	
Celina [c]	89	24	57.7	2.01	
Circleville	88	28	57.9	2.75	
Clarksville	86	32	60.4	1.84	
Cleveland *a*	83	32	57.3	2.60	
Cleveland *b*	84	33	56.2	2.25	
Clifton	90	21	56.5	2.06	
Coalton	89	23	58.6	1.42	
Colebrook	82	22	53.8	2.30	
Dayton *a*	91	26	59.4	2.06	
Dayton *b*				1.99	
Defiance	87	23	58.9	2.63	
Delaware	88	22	57.6	2.61	
Demos	81	29	55.6	1.52	
Dupont	84	23	53.2	1.88	
Elyria	88	27	57.6	2.33	
Findlay	90	24	58.8	1.91	
Frankfort	86	25	56.4	3.11	
Garrettsville	86	24	54.8	1.88	
Gratiot	84	24	56.2	1.74	
Greenfield	81	33	58.7	2.15	
Greenhill	86	21	54.8	1.88	
Greenville	82	28	57.0	2.62	
Hanging Rock	86	27	59.0	1.24	
Hillhouse	85	24	55.5	2.53	
Hillsboro	87	24	57.4	1.89	
Hiram	83	31	57.2	2.14	
Hudson	85	25	55.4	2.36	
Jacksonboro	90	34	60.6	1.90	
Kenton	94	24	60.2	2.05	
Killbuck	84	25	57.0	1.81	
Lancaster	85	26	58.4	2.16	
Leipsic	89	23	56.8	2.80	
Levering				2.37	
Lordstown	85	22	54.5	1.93	
McArthur	85	24	57.0	0.60	
McConnelsville	89	27	57.5	1.41	
Mansfield				3.20	
Marietta	80	32	58.3	1.80	
Marion	89	24	59.4	1.79	
Medina	88	23	57.2	2.81	
Milfordton	87	22	55.4	2.44	
Milligan	90	22	56.8	2.02	
Millport	84	21	54.2	1.78	
Montpelier	84	22	55.6	4.50	
Napoleon	86	27	55.0	2.24	
Neapolis				2.62	
New Alexandria	81	26	56.8	2.60	
New Berlin	84	25	56.6	2.22	
New Holland	86	26	58 4	1.51	
New Paris	88	31	61.2[1]	2.69	
New Richmond	92	31	61.2	1.30	
New Waterford	82	25	54.9	1.85	
North Lewisburg	88	26	58.3	2.30	
North Royalton	88	26	58.0	2.52	
Norwalk	87	23	56.8	2.30	
Oberlin	89	21	55.8	2.51	
Ohio State University	86	23	57.8	2.15	
Orangeville	81	22	53.2	1.55	
Ottawa	88	21	57.8	2.36	
Pataskala	87	22	57.0	2.44	
Perry				2.08	
Philo	84	28	57.2	2.40	
Plattsburg	88	27	59.5	2.07	
Pomeroy	82	27	58.2	1.20	
Portsmouth *a*				1.60	
Portsmouth *b*	86	28	60.5	1.60	
Pulse				1.60	
Richwood	89	21	59.7	1.91	
Ridgeville Corners	86	23	57.0	2.24	
Ripley	84	30	58.8	2.01	
Rittman	82	25	54.2	2.36	
Rockyridge	88	22	57.6	2.03	
Rosewood	84	26	59.0	2.23	
Seaman	86	25	57.8	1.73	
Shenandoah	88	24	56.4	2.11	
Sidney	89	26	58.0	2.21	
Sinking Spring	86	30	60.2	2.10	
Somerset	82	31	59.6	1.87	
Springboro				2.45	
Strongsville				2.86	
Thurman	87	27	59.8	0.93	
Tiffin	85	27	57.3	2.15	
Upper Sandusky	86	22	58.4	2.16	
Urbana	82	27	57.6	2.38	
Vanceburg	86	31	58.3	2.90	
Vermillion	86	26	57.2	2.09	
Vickery	89	21	56.8	1.98	
Walnut				2.96	
Warren	83	25	55.6	2.13	
Warsaw	88	22	55.7	1.76	
Wauseon	89	20	57.0	2.50	
Waverly	87	26	59.4	1.68	
Waynesville				2.44	
Wellington	86	25	56.3	1.98	
Westerville	81	26	57.6	2.85	
Willoughby				2.38	
Wooster	92	22	55.0	2.21	
Zanesville				1.78	
Oklahoma.					
Arapaho	92	36	63.4	3.44	
Beaver	88	32	59.7	1.77	
Burnett	93	32	65.1	3.69	
Fort Reno	95	37	65.6	3.10	
Fort Sill	96	42	69.0	5.10	
Guthrie	91	39	67.2	4.08	
Hennessey	96	36	68.4	3.37	
Hopeton	92	32	64.8	2.81	
Jefferson	98	29	64.8	2.33	
Kingfisher	93	33	66.6	5.24	
Mangum	93	36	63.5	2.52	
Newkirk	91	31	64.2	3.34	
Norman	95	31	65.8	4.93	
Pawhuska	94	32	64.6	7.03	
Perry	93	36	67.2	4.61	
Sac and Fox Agency	94	32	63.1	4.09	
Stillwater	92	32	67.2	5.15	
Waukomis	95	32	66.2	3.00	
Woodward	92	22	63.4	2.25	
Oregon.					
Albany *b*				3.17	
Alpha	82	29	52.6	8.50	
Arlington	81	28	51.9	1.51	
Ashland *b*	88	26	50.0	2.38	
Aurora [1]	80	35	51.3	4.66	
Aurora (near)	78	29	50.2	3.67	
Bandon	74	33	50.8	6.98	
Bay City	82	29	52.1	8.55	
Beulah	80	18	43.0	1.60	
Blalock	83	36	53.8	1.51	
Brownsville [1]	78	29	51.9	2.75	
Bullrun	66	30	47.8	8.08	
Burns	79	17	42.4	1.32	
Cascade Locks	74	30	51.6	7.04	
Comstock [1]	80	26	51.2	5.62	
Coquille				6.24	
Corvallis	82	25	51.2	3.97	
Dayville	87	18	48.2	1.80	0.5
Ella				1.89	
Eugene	79	26	51.4	2.68	
Falls City	71	28	49.0	7.25	
Forestgrove	87	25	49.0	5.53	
Gardiner	74	35	52.5	7.39	
Glenora	81	22	47.9	10.75	
Government Camp	69	18	40.2	10.23	0.3
Grants Pass	88	25	51.0	4.20	
Happy Valley	78	9	41.1	1.74	0.3
Heppner	81	20	47.6	2.07	1.0
Hood River (near)	76	24	49.2	3.62	
Irvington	78	31	52.4	3.73	
Jacksonville	90	28	50.6	2.89	
Joseph	74	19	41.4	2.22	6.0
Junction City [1]	82	28	52.2	3.92	
Kerby	81	23	49.5	7.07	
Lafayette [1]	78	32	51.0	5.47	
Lagrande	80	23	46.2	3.05	1.5
Lakeview	72	22	41.8	2.60	6.0
Langlois	90	33	54.0	9.61	
Lonerock	82	5	42.0	2.01	0.5
McMinnville	81	25	50.6	5.23	
Merlin [1]	75	25	50.3	2.88	
Monmouth *a* [1]	83	32	53.0	4.07	
Monmouth *b*	82	27	51.5	4.16	
Monroe	79	29	51.8	4.85	
Mount Angel	81	28	51.2	3.73	
Nehalem				11.32	
Newberg	82	26	50.6	4.40	
Newbridge	78	16	44.0	1.38	
Newport	80	27	52.0	7.87	
Pendleton	86	22	51.6	2.22	T.
Placer				6.04	
Prineville	81	19	50.6	1.77	T.
Riddles [1]	79	33	55.3	2.40	
Riverside	79	— 2	37.7	1.67	
Salem *b*	73	23	50.1	3.95	
Sheridan [1]	80	30	50.9	4.85	
Silverlake	80	11	41.8	1.44	1.2
Silverton [1]	76	34	53.8	4.10	
Siskiyou [1]	78	30	49.1	2.30	5.0
Sparta	76	23	44.4	3.00	9.0
Springfield [1]	78	23	50.2	2.79	
Stafford	83	29	50.8	4.90	
The Dalles	78	29	51.4	1.56	
Toledo	87	26	52.9	2.95	
Umatilla				1.82	
Vale	75	16	45.0	1.31	
Vernonia	93	25	51.5	5.61	
Westfork [1]	70	26	45.8	3.72	
Weston	85	20	47.1	2.91	1.3
Oregon—Cont'd.	°	°	°	*Ins.*	*Ins.*
Williams	84	22	48.4	3.17	
Pennsylvania.					
Altoona	80	25	53.9	1.23	
Aqueduct	79	28	57.4	1.85	
Athens	85	19	53.6	1.38	
Beaver Dam				1.49	
Bethlehem				1.15	
Brookville				2.48	
Browers Lock				1.40	
Butler	80	26	53.8	2.24	
Carlisle				2.98	
Cassandra	77	26	53.5	0.79	
Cedarrun				2.30	
Centerhall	76	26	53.8	2.12	
Chambersburg	78	26	54.0	1.35	
Coatesville	84	25	56.9	1.74	
Confluence	86	25	55.2	0.70	
Coopersburg	79	28	55.8	1.48	
Davis Island Dam				1.23	
Derry Station	94	25	56.9	0.72	
Doylestown				1.93	
Driftwood				0.40	
Duncannon				3.24	
Dushore				1.36	
Dyberry	82	16	51.2	0.69	
East Bloomsburg				1.63	
East Mauch Chunk	83	21	54.4	1.49	
Easton	74	25	55.2	0.82	
Ellwood Junction				1.11	
Emporium	82	23	53.3	2.21	
Ephrata	82	26	56.3	1.18	
Everett	78	26	54.8	1.10	
Farrandsville				0.75	
Forks of Neshaminy [1]	74	28	54.0	2.04	
Franklin	87	23	55.8	2.58	
Frederick				1.14	
Freeport				1.12	
Girardville				1.02	
Grampian	78	26	54.2	1.56	
Greensboro	84	22	55.6	1.18	
Hamburg	80	29	56.7	1.40	
Hawley	84	15	52.0	2.30	
Hawthorn	88	22	55.0	2.20	
Hews Island Dam				0.93	
Huntingdon *a*	89	24	55.0	1.26	
Huntingdon *b*				0.49	
Irwin				0.71	
Johnstown	86	28	56.8	0.97	
Keating				0.50	
Kennett Square	81	26	57.2	2.03	
Lansdale				1.29	
Lawrenceville	84	18	50.1	0.41	
Lebanon	79	24	54.6	0.95	
Leroy	79	22	53.4	1.34	
Lewisburg	79	25	54.0	1.36	
Lockhaven *a*	82	25	55.8	1.12	
Lockhaven *b*				0.43	
Lock No. 4				0.69	
Lycippus	87	28	57.2	2.31	
Mifflin				0.60	
Nisbet				0.38	
Oil City				1.72	
Parker				1.64	
Philadelphia	80	33	59.0	2.06	
Quakertown	82	23	54.8	1.17	
Reading [2]			53.3	1.30	
Renovo *a*				0.54	
Renovo *b*	82	25	54.3	1.23	
Saegerstown	85	22	53.7	0.79	
St. Marys	80	23	52.5	3.81	
Salem Corners	83	19	54.0	0.71	
Scranton	82	19	53.2	0.63	
Selinsgrove *a*	76	25	53.4	1.53	
Shawmont				1.83	
Shinglehouse	81			2.38	
Sinnamahoning				0.66	
Smethport	83	20	51.6	2.58	
Smiths Corners				1.60	
Somerset	82	21	53.5	2.79	
South Eaton	80	19	53.6	1.16	
State College	79	26	54.2	1.40	
Sunbury				0.50	
Swiftwater	75	20	50.6	2.07	
Towanda	79	19	53.1	1.21	
Troutrun				1.26	
Uniontown	81	28	57.0	1.76	
Warren	83	24	55.2	1.44	
Wellsboro	83	22	52.6	2.63	
Westchester	78	29	56.8	1.91	
West Newton				0.53	
Westtown	76	29	55.0	1.56	
Wilkesbarre	81	22	53.5	1.29	
Williamsport	80	26	53.0	3.26	
York	78	24	54.2	0.99	
Rhode Island.					
Bristol	72	34	55.2	1.58	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Rhode Island—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kingston	77	25	53.0	2.43	
Lonsdale	.....	.....	.....	1.92	
Pawtucket	75	32	53.3	1.10	T.
Providence[a]	75	32	54.6	1.68	
Providence[c]	76	30	53.6	2.01	
South Carolina.					
Allendale	86	45	67.0	4.78	
Anderson	.....	.....	.....	3.80	
Batesburg	87	40	64.2	6.25	
Beaufort	88	50	70.0	8.32	
Blackville	91	43	65.8	9.63	
Calhoun Falls	.....	.....	.....	4.23	
Camden	.....	.....	.....	6.75	
Cheraw[a]	85	39	62.4	5.62	
Cheraw[b]	.....	.....	.....	6.30	
Clemson College	88	38	62.6	3.35	
Conway	.....	.....	.....	3.85	
Darlington	.....	.....	.....	6.31	
Edisto	.....	.....	.....	5.09	
Effingham	.....	.....	.....	3.72	
Florence	85	40	64.0	4.83	
Gaffney	.....	.....	.....	1.97	
Gillisonville	86	47	66.2	7.37	
Greenville	86	36	60.4	2.03	
Greenwood	83	39	61.6	5.05	
Holland	.....	.....	.....	4.56	
Kingstree[a]	84	42	64.0	2.21	
Kingstree[b]	.....	.....	.....	2.29	
Little Mountain	88	39	64.4	6.49	
Longshore	88	39	62.9	5.56	
Pinopolis[*1]	82	48	64.5	5.50	
St. Georges	86	44	65.2	2.00	
St. Matthews	88	43	64.2	7.67	
St. Stephens	.....	.....	.....	3.34	
Santuck	85	36	62.2	4.70	
Shaws Fork	88	40	64.1	6.60	
Smiths Mills	.....	.....	.....	4.23	
Societyhill	82	41	63.6	8.26	
Spartanburg	84	34	60.8	2.35	
Statesburg	87	41	65.1	7.37	
Summerville	85	44	65.6	5.34	
Temperance	91	38	64.6	4.25	
Trenton	84	45	65.6	7.13	
Trial	87	41	62.8	5.40	
Walhalla	84	35	60.6	3.69	
Winnsboro	81	28	61.4	7.88	
Yemassee	86	47	69.8	6.13	
Yorkville	86	39	64.2	3.32	
South Dakota.					
Aberdeen	74	15	41.4	0.75	T.
Academy	90	19	49.8	0.71	
Alexandria	88	26	51.2	1.28	
Armour	84	20	50.0	2.18	8.0
Ashcroft	92	10	44.1	1.58	2.0
Bowdle	80	15	42.8	0.73	0.2
Brookings	80	17	48.3	2.21	
Canton	84	23	52.6	2.53	T.
Centerville	.....	.....	.....	1.79	
Chamberlain	90	23	51.6	0.72	0.2
Clark	.....	.....	.....	2.22	
Desmet	78	23	48.6	4.41	
Doland	78	18	48.0	2.45	
Elkpoint	88[c]	26[c]	56.4[c]	2.02	2.0
Farmingdale	.....	.....	.....	1.11	T.
Flandreau	83	21	51.4	1.98	
Forestburg	81	26	48.8	3.71	
Forest City	81	23	46.1	0.80	
Fort Meade	87	22	47.2	1.94	
Gannvalley	88	20	50.7	1.10	2.0
Gary	81	26	47.8	2.97	
Grand River School	93	19	46.6	....	
Hartman	83	25	51.0	1.32	
Highmore	85	26	50.4	0.84	
Hitchcock	.....	.....	.....	1.34	
Hotch City	.....	.....	.....	0.97	
Hot Springs	.....	.....	.....	3.24	
Howard	85	18	49.6	1.85	0.5
Interior	90	28	52.2	2.03	2.0
Ipswich	78	18	45.2	0.95	
Kimball	88	22	49.6	1.09	2.5
Leola	78[c]	17[c]	44.7[c]	0.82	
Leslie	96	20	47.2	0.43	
Mellette	81	18	46.5	0.78	
Menno	86	12	51.0	0.61	
Millbank	78	25	49.8	1.77	
Mitchell	85	21	50.3	1.83	
Oelricks	82	15	45.5	2.05	4.0
Parker	84	20	49.8	0.95	
Plankinton	86	22	49.2	2.18	
Redfield	79	18	48.2	1.13	
Rochford	82	15	41.4	1.17	
Rosebud	92	6	47.1	0.76	
Shiloh	.....	.....	.....	0.75	
Silver City	.....	.....	....	1.95	12.0
Sioux Falls	83	16	50.6	1.94	
Spearfish	86	25	47.2	0.84	1.5

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum	Mean.	Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Tyndall	87	20	51.9	0.63	
Watertown	75	24	45.6	2.75	
Waubay	75	20	46.6	1.87	T.
Wentworth	79	23	48.1	1.89	
Wessington Springs	70	20	46.3	1.10	
Whiteswan	.....	.....	.....	1.85	
Wolsey	.....	.....	.....	0.99	
Tennessee.					
Andersonville	81	31	58.2	1.83	
Arlington	87	32	61.9	2.47	
Ashwood	87	33	63.6	2.94	
Benton	86	29	62.6	2.84	
Bluff City	.....	.....	.....	0.94	
Bolivar	89	34	63.1	2.55	
Bristol	78	29	57.0	1.22	
Brownsville	88	41	64.6	2.63	
Carthage	88	33	63.1	2.04	
Clarksville	86	36	63.8	2.07	
Clinton	.....	.....	.....	3.95	
Covington	90	40	66.2	1.99	
Decatur	81	33	61.4	3.41	
Dover	82	31	59.9	1.81	
Dyersburg	87	38	63.6	2.47	
Elizabethton	83	28	60.5	1.23	
Elk Valley	.....	33	.....	1.12	
Erasmus	83	.....	.....	4.02	
Florence	84	34	62.0	2.11	
Franklin	87	35	63.0	2.19	
Grace[*1]	82	42	62.8	2.70	
Greeneville	79	32	58.8	2.12	
Harriman	80	33	60.3	4.77	
Hohenwald	86	32	60.2	2.42	
Jackson	87[c]	35[c]	65.4[c]	2.80	
Johnsonville	91	29	62.1	2.38	
Jonesboro[*1]	78	38	57.6	1.77	
Kingston	.....	.....	.....	3.86	
Lafayette[*5]	84[c]	34[b]	62.7[c]	1.18	
Lewisburg	87	31	63.2	3.25	
Liberty	82	31	62.4	2.51	
Lynnville	86	38	64.7	4.27	
McMinnville	84	32	61.9	3.15	
Madison	87	33	62.6	1.28	
Maryville[*5]	84	37	61.2	2.46	
Milan	87	36	64.0	2.30	
Nunnelly	88	29	62.0	1.38	
Oakhill	84	31	62.2	3.61	
Palmetto	88	30	63.8	3.25	
Peryear[*5]	.....	.....	.....	1.75	
Pope	90	29	61.8	2.17	
Rogersville	79	31	59.3	1.85	
Rugby	79	28	58.8	3.21	
Savannah	87	33	64.1	3.30	
Sewanee	81	38	61.8	3.74	
Silverlake	76	24	54.6	1.45	
Springdale	88	27	61.2	2.62	
Springfield	89	30	63.1	0.95	
Tazewell	.....	.....	.....	2.78	
Tellico Plains	88	30	61.8	1.99	
Tracy City	79	34	58.6	2.90	
Trenton	92	32	64.0	2.71	
Tullahoma	87	30	62.5	2.55	
Union City	88	37	63.8	1.85	
Waynesboro	88	26	61.6	2.40	
Wildersville	85	35	63.4	3.01	
Yukon	87	37	64.8	1.78	
Texas.					
Alvin	.....	.....	.....	6.08	
Anna	93	36	70.0	2.87	
Arthur	.....	.....	.....	4.29	
Austin[a]	93	39	70.6	5.45	
Austin[b*2]	94	41	69.8	.....	
Ballinger	92	39	67.6	1.52	
Beaumont	90	40	72.2	1.00	
Beeville	97	41	73.6	3.28	
Blanco	91[1]	50[1]	72.1[1]	6.42	
Boerne[*1]	90	44	69.5	8.96	
Brazoria	86	45	72.5	9.00	
Brenham	92	44	71.8	2.97	
Brighton	96[c]	52[c]	78.2[c]	3.15	
Brownwood	.....	.....	.....	2.25	
Burnet[*1]	92	41	68.8	3.18	
Camp Eagle Pass	94	40	73.2	3.00	
College Station	.....	.....	.....	2.87	
Colorado	.....	.....	.....	1.84	
Columbia	88	41	71.1	8.69	
Conroe	86	44	72.1	3.46	
Corsicana	94	42	72.6	2.78	
Cuero	96	43	73.5	1.88	
Dallas	94	40	68.8	2.35	
Danevang	94	42	73.4	7.96	
Dublin	92	42	67.6	3.60	
Duval	92	48	72.0	3.57	
Emory	.....	38	.....	3.49	
Estelle	95	39	69.7	2.57	
Forestburg	.....	.....	....	3.05	
Fort Brown	92	38	72.6	5.96	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd	°	°	°	*Ins.*	*Ins.*
Fort Clark	91	45	71.5	3.81	
Fort McIntosh	97	42	75.2	2.71	
Fort Ringgold	97	.....	.....	7.87	
Fredericksburg[*1]	92[1]	40	69.0	2.95	
Fruitland	96	42	70.2	4.11	
Gainesville	92	42	69.2	4.08	
Grapevine	98	42	70.0	2.29	
Hale Center	87	37	64.1	1.41	
Hallettsville	93	48	73.2	2.13	
Hearne	89	42	71.2	5.70	
Henrietta	94	39	68.0	4.65	
Hewitt	.....	....	....	7.40	
Hondo	.....	.....	.....	2.10	
Houston	88	46	72.4	6.09	
Hulen	91	43	73.0	7.58	
Huntsville	89	40	70.5	3.35	
Jacksonville	90	37	69.4	3.71	
Jasper	90	39	72.3	2.05	
Kent	.....	.....	.....	0.10	
Kerrville	90	36	68.4	3.45	
Lampasas	95	39	69.8	4.90	
Laureles Ranch	.....	.....	.....	5.03	
Llano[*5]	93	39	71.8	4.00	
Longview	93	41	69.9	5.60	
Luling	94	42	72.9	1.62	
Mann	.....	.....	.....	3.05	
Marathon	86	30	60.6	0.78	
Menardville	.....	....	.....	2.39	
Monahans	.....	.....	.....	0.90	
Mount Blanco	88	35	64.2	0.09	
New Braunfels	93	41	72.3	2.43	
Panter	.....	.....	.....	1.85	
Paris[a]	95	42	70.6	2.97	
Paris[b*1]	93	48	70.6	.....	
Point Isabel[*1]	88	60	77.7	2.80	
Rhineland	97	35	68.6	4.77	
Rockisland	92	44	72.5	2.41	
Rockport[*1]	85	55	75.1	.....	
Runge	94	41	75.0	1.15	
Sabine	88	48	72.6	0.95	
Sanderson	.....	.....	.....	.....	T.
San Marcos	93	39	71.1	3.00	
Sugarland	90	42	71.8	4.35	
Sulphur Springs	93	41	69.6	3.23	
Temple[a]	92	45	71.1	4.90	
Temple[b]	94	41	69.0	.....	
Tulia	87	30	60.2	0.65	
Tyler	90	41	69.2	2.75	
Valentine	85	32	59.8	1.10	
Victoria	.....	.....	.....	3.33	
Waco	93	44	71.0	4.10	
Waxahachie	92	37	68.4	3.85	
Weatherford	93	40	69.2	2.85	
Wichita Falls	.....	.....	.....	5.36	
Utah.					
Bluecreek[*1]	68	29	43.2	2.54	0.5
Brigham	.....	.....	.....	2.96	
Castledale	82	20	47.4	0.25	
Ci-co	86	22	48.9	0.50	
Corinne	80	26	49.2	1.85	2.0
Croydon	.....	.....	.....	2.10	7.0
Deseret	86	16	46.2	1.23	2.0
Elgin	84	22	47.2	0.60	
Fillmore	86[1]	21[1]	46.8[1]	1.94	
Fort Duchesne	79	19	44.0	0.83	
Frisco	84	25	46.6	0.51	2.0
Giles	87	20	50.1	0.26	
Grover	77	13	42.2	0.40	2.0
Heber	76	14	40.2	3.20	.....
Huntsville	.....	.....	.....	3.86	9.0
Kelton[*1]	71	27	47.0	0.30	
Levan	80	21	45.0	2.07	2.0
Loa	77	10	40.4	0.22	T.
Logan	75	27	46.4	2.58	
Manti	77	23	46.2	2.38	2.0
Marysvale	.....	.....	.....	2.00	19.0
Millville	.....	.....	.....	2.84	
Minersville	81	21	47.6	1.38	.....
Moab	88	28	53.2	1.06	
Mount Pleasant	84	21	46.8	1.80	4.0
Ogden[a*1]	70	31	52.0	2.45	2.0
Pahreah	96	28	52.0	1.10	
Parowan	80	18	46.2	0.78	3.2
Pinto	74	16	44.2	1.75	
Promontory	.....	.....	.....	0.50	2.5
Provo	88	12	46.6	2.79	
Richfield	76	21	46.7	0.88	1.5
St. George	93	23	54.8	0.45	
Scipio	80	16	43.5	2.06	4.0
Snowville	75	20	43.5	1.24	
Soldier Summit	65	19	40.2	1.60	16.0
Terrace	.....	.....	.....	0.50	T.
Thistle	79	20	45.0	0.40	1.5
Tooele	73	29	48.0	1.46	
Tropic	76	12	42.2	1.34	
Vernal	80	24	44.1	1.04	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Woodruff	83	9	38.8	1.24	12.0
Vermont.					
Bennington	79	21	52.0	0.95	
Brattleboro	77	21	52.0	1.19	
Burlington	75	30	53.0	2.81	T.
Chelsea	73	21	47.0	2.33	1.0
Cornwall	76	23	51.6	2.57	
Derby	77	20	48.5	1.98	T.
Enosburg Falls	77	16	49.6	3.99	T.
Hartland	75	17	48.2	1.56	T.
Jacksonville	78	20	48.3	0.70	
Norwich	77	21	48.5	1.54	T.
St. Johnsbury	72	18	47.4	2.40	T.
Vernon *[8]	74	23	50.4	2.08	T.
Wells	73	22	50.0	1.78	
Woodstock	74	16	47.1	2.10	T.
Virginia.					
Alexandria	81	32	60.3	2.78	
Ashland	80	32	58.4	3.98	
Barboursville	88	31	60.8	3.50	
Bedford	80	31	56.4	2.18	
Bigstone Gap	88	30	59.2	1.73	
Birdsnest *[1]	82	39	61.5	5.80	
Blacksburg	78	21	54.6	1.58	
Buckingham	.....	.....	.....	3.35	
Burkes Garden	75	20	51.4	1.12	
Callaville	77	32	59.0	6.11	
Charlottesville	79	35	59.4	3.15	
Christiansburg	.....	.....	.....	1.11	
Cliftonforge	75	32	56.8	0.89	
Columbia	.....	.....	.....	3.30	
Dale Enterprise	86	23	55.8	2.04	
Doswell	80	32	58.6	2.02	
Dwale	.....	.....	.....	1.70	
Farmville	.....	.....	.....	2.01	
Fontella [4]	84	36	62.9	3.35	
Fredericksburg	80	33	58.9	4.38	
Graham Forge	79	25	56.1	1.27	
Hampton	78	41	64.0	5.24	
Lexington	80	29	57.6	2.08	
Manassas	79	32	58.0	2.60	
Marion	81	24	57.6	1.75	
Meadow Dale	75	28	54.4	.....	
Miller School	.....	.....	.....	2.26	
Newport News	80	32	64.8	2.71	
Petersburg	82	33	60.4	3.05	
Quantico	77	27	55.6	.....	
Radford	.....	.....	.....	0.39	
Richmond (near)	79	34	59.0	3.43	
Rockymount	78	30	59.0	3.77	
Salem	82	33	61.4	2.08	
Scottsburg	79	31	59.2	3.61	
Speers Ferry	.....	.....	.....	1.55	
Spottsville	80	30	60.2	4.41	
Stanardsville	81	33	58.3	2.87	
Staunton	82	29	58.2	3.06	
Stephens City	81	28	58.6	2.76	
Sunbeam	82	34	62.1	5.17	
Tobaccoville	80	29	59.0	3.82	
Warrenton	72	32	57.6	2.53	
Warsaw	78	30	58.4	3.43	
Westbrook Farm	82	35	59.1	.....	
Westpoint	.....	.....	.....	4.65	
Woodstock	79	28	56.4	2.06	
Wytheville [3]	80	26	57.4	1.29	
Washington.					
Aberdeen	81	30	50.6	9.17	
Anacortes	.....	.....	.....	3.09	
Ashford	.....	.....	.....	8.58	
Bremerton	84	30	51.2	2.90	
Bridgeport	74	25	51.0	.....	
Brinnon	75	33	49.6	4.95	
Cedar Lake	.....	.....	.....	12.87	
Cedonia	69	18	41.2	2.02	2.0
Centerville	76	24	47.0	1.88	
Chehalis	82	29	50.6	4.81	
Cheney	.....	.....	.....	2.14	
Clearwater	76	29	49.6	13.73	
Cle Elum	73	13	44.2	2.13	T.
Colfax	.....	.....	.....	2.51	2.0
Colville	80	27	50.7	1.60	
Connell	.....	.....	.....	0.39	
Crescent	80	15	45.0	2.26	0.6
Dayton	77	20	46.8	2.37	
Ellensburg	67	15	45.0	0.65	
Ellensburg (near)	70	18	46.8	0.50	
Fort Simcoe	79	37	48.4	1.25	
Grandmound	79	25	50.2	5.44	
Hooper	84	18	50.0	1.46	
Kennewick	83	22	52.2	1.69	
Lacenter	79	29	49.3	5.76	
Lakeside	71	32	49.4	1.50	
Lind	81	22	49.6	1.63	0.2
Loomis	74	28	48.0	.....	
Mayfield	70	30	51.6	5.89	
Monte Cristo	71	28	46.0	10.21	1.2

Stations	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Moxee Valley	80	16	47.8	0.82	
New Whatcom	69	27	50.7	2.63	
Northport	69	15	42.9	2.04	
Olga	67	35	47.4	3.78	
Olympia	80	27	50.8	4.69	
Orcas Island	.....	.....	.....	3.21	
Pinehill	74	24	49.8	2.19	T.
Pomeroy	76	30	50.8	2.08	1.0
Port Townsend	76	35	50.7	1.79	
Pullman	84	22	46.1	2.74	.....
Ritzville	.....	.....	.....	0.93	0.5
Rosalia	76	18	45.0	2.30	0.3
Sedro	85	35	50.8	3.98	
Shoalwater Bay *[10]	75	38	52.4	.....	
Snohomish	79	28	49.2	5.43	
Snoqualmie	83	38	55.4	5.93	
Southbend	86	28	51.2	8.85	
Sunnyside	81	21	49.4	0.89	
Twin	75	29	49.0	7.06	
Union	76	29	50.4	6.52	
Usk [4]	73	19	42.7	.....	
Vancouver	78	26	50.8	5.05	
Vashon	69	32	50.2	3.17	
Waterville	74	18	42.6	1.26	0.5
Wenatchee (near)	72	27	46.0	1.24	2.0
West Virginia.					
Beverly	87	20	55.2	1.32	
Bluefield	78	31	57.8	1.23	
Buckhannon *b*	83	32	54.6	...	
Burlington	81	23	54.7	2.32	
Central	85	23	56.6	1.68	
Charleston	.....	.....	.....	1.41	
Dayton	83	21	55.1	0.88	
Eastbank	79	34	56.8	1.24	
Elkhorn	79	27	58.6	1.28	
Fairmont	.....	.....	.....	0.43	
Glenville	81	28	56.4	0.97	
Grafton	87	24	57.8	1.21	
Hamlin	84	34	60.9	1.74	
Harpers Ferry	.....	.....	.....	1.51	
Highland Springs	81	27	56.5	2.33	
Hinton *a*	.....	.....	.....	0.71	
Hinton *b* [6]	80	34	58.9	.....	
Huntington	84	33	58.8	1.14	
Kingwood	83	23	56.0	1.16	
Lanes Bottom	.....	.....	.....	3.81	
Madison	88	32	61.6	1.35	
Marlinton	79	19	53.4	1.56	
Martinsburg	76	29	54.8	1.95	
New Cumberland	91	27	59.1	2.81	
New Martinsville	86	30	58.8	1.56	
Nuttallburg	85	24	59.3	1.55	
Oceana	82	28	57.3	1.27	
Oldfields	81	22	55.0	1.86	
Parsons	83	26	54.8	1.10	
Philippi *a*	89	25	58.0	1.01	
Philippi *b*	.....	.....	.....	0.64	
Point Pleasant	87	30	58.8	1.13	
Powellton	80	28	55.2	0.23	
Romney	78	27	56.3	1.66	
Rowlesburg	.....	.....	.....	0.80	
Terra Alta	.....	.....	.....	1.50	
Uppertract	83	21	56.0	1.86	
Weston *a*	.....	.....	.....	0.57	
Weston *b*	87	35	58.5	.....	
Wheeling *a*	.....	.....	.....	1.41	
Wheeling *b*	82	32	58.5	2.47	
Wisconsin.					
Amherst	83	22	50.8	1.70	
Barron	.....	.....	.....	4.26	
Bayfield	70	29	49.8	3.40	
Beloit	83	31	54.9	1.50	
Brodhead	87	25	55.8	2.17	
Butternut	81	17	47.9	5.08	
Citypoint	85	21	52.4	2.35	
Dodgeville	84	25	54.4	1.48	
Easton	84	22	53.6	1.65	
Eau Claire	84	28	52.2	3.61	
Florence	79	30	47.4	4.30	
Fond du Lac	85	27	54.3	2.22	
Grand River Locks	.....	.....	.....	2.00	
Grantsburg	82	25	49.2	4.63	
Hartford	84	24	55.0	2.52	
Hartland [7]	84	29	55.0	0.99	
Harvey	83	26	53.6	1.98	T.
Hayward	79	21	48.6	6.51	
Heafford	77	20	48.2	3.85	T.
Hillsboro	82	25	53.2	2.19	
Knapp	.....	.....	.....	4.45	
Koepenick *[1]	78	30	52.6	4.10	
Lancaster	84	25	54.2	1.68	
Lincoln	84	30	53.2	1.48	
Madison	80	32	53.5	1.58	
Manitowoc	81	27	51.3	1.42	
Meadow Valley	88	22	52.1	1.53	
Medford	80	18	48.2	4.50	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Menasha	.....	.....	.....	1.75	
Neillsville	80	22	50.8	3.52	
New Holstein	.....	29	.....	2.05	
New London	83	23	51.8	2.24	
Oconto	85	21	52.2	1.13	
Osceola	80	21	48.8	3.72	T.
Oshkosh	76	28	52.8	1.22	
Pepin	84	26	52.3	3.79	
Pine River	84	24	52.6	1.65	
Portage	81	30	53.4	1.52	
Port Washington	85	28	52.8	1.80	
Prairie du Chien	88	29	57.0	2.08	
Prentice *[1]	76	16	45.7	5.56	
Racine	85	31	55.8	1.34	
Sharon	86	28	54.8	1.16	
Shawano	84	22	50.8	1.62	
Sheboygan	81	30	51.8	1.89	T.
Spooner	82	15	51.8	3.48	
Stevens Point	84	23	51.5	1.86	
Sturgeon Bay Canal *[10]	79	27	48.7	.....	
Two Rivers *[10]	66	31	51.5	.....	
Valley Junction	85	20	52.4	1.04	T.
Viroqua	82	29	55.7	1.83	T.
Watertown	82	26	53.2	2.14	
Waukesha	83	31	55.2	1.21	
Waupaca	83	22	51.6	1.42	
Wausau	80	22	48.8	3.27	
Westbend [7]	84	16	56.2	2.3	
Westfield	80	25	52.3	1.29	
Whitehall	81	24	50.8	2.35	
Wyoming.					
Alcova	81	10	40.0	1.07	T.
Basin	81	20	43.2	0.38	.....
Bedford	69	12	37.3	2.29	7.0
Buffalo	83	19	42.5	0.70	2.0
Burns	72	6	32.6	1.42	4.0
Carbon [5]	76	15	42.4	1.56	.....
Centennial	71	14	36.8	4.81	47.6
Douglas [6]	84	20	46.4	2.53	1.5
Embar	78	15	45.4	.....	.....
Evanston	70	11	36.9	2.87	26.0
Fort Laramie	91	20	46.4	2.69	
Fort Washakie	80	18	43.0	1.39	10.0
Fort Yellowstone	74	13	37.5	2.02	12.8
Fourbear	76	— 1	37.2	1.64	17.8
Hyattville	79	22	44.0	.....	.....
Iron Mountain	77	16	42.6	0.64	.....
Laramie	72	8	38.4	1.13	.....
Lovell	80	12	41.5	0.35	1.8
Lusk	82	14	41.8	2.42	T.
Rawlins	70	14	40.2	0.64	6.4
Rocksprings	80	3	37.1	0.60	3.0
Sheridan	83	18	42.0	0.82	0.2
Thayne	67	11	38.6	2.32	8.8
Wamsutter	63	20	44.6	0.60	6.0
Mexico.					
Ciudad P. Diaz	86	51	78.1	2.91	
Coatzacoalcos [2]	.....	.....	79.7	.....	
Leon de Aldamas	82	37	64.4	1.14	
Puebla	75	49	63.3	2.29	
Tampico [2]	.....	.....	76.7	.....	
Vera Cruz [2]	.....	.....	81.1	.....	
New Brunswick.					
St. John	67	31	47.3	1.87	
Porto Rico.					
Adjuntas	88	58	72.4	11.75	
Aguadilla	86	73	78.0	8.75	
Arecibo	90	68	78.4	.....	
Bayamon	94	67	79.9	9.79	
Caguas	90	64	77.8	9.36	
Canovanas	85	72	77.4	5.03	
Cayey	88	63	75.0	7.27	
Cidra	84	64	74.1	7.52	
Coamo	93	66	78.1	6.32	
Coloso	.....	.....	.....	11.60	
Corozal	90	65	77.2	6.80	
Fajardo	89	68	79.1	17.07	
Guayama	95	70	80.3	5.87	
Humacao	71	.....	.....	9.78	
Isabela	87	70	78.1	6.94	
La Isolina	88	65	75.8	8.31	
Lajas	94	64	79.2	12.33	
Luquillo	87	72	78.8	17.74	
Manati	94	66	79.6	5.79	
Mayaguez	89	73	82.4	8.73	
Morovis	86	68	77.4	5.11	
Ponce	90	66	77.4	11.04	
Puerta de Tierra	91	73	81.0	9.78	
San Lorenzo	92	69	78.9	9.61	
Vieques	91	68	81.9	10.43	
Yanco [7]	89	71	80.8	5.43	
Cuba.					
Batabano	96	65	81.3	2.99	
Soledad	90	59	77.6	5.87	

TABLE II.—*Late reports for September*, 1899.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alaska.	°	°	°	*Ins.*	*Ins.*
Coal Harbor	66	32	48.8	4.99	
Killisnoo	59	35	46.8	7.40	
Skagway	76	30	51.8	4.68	
Arizona.					
Bowie *[1]	90	65	75.1	0.00	
Cochise	.....	.....	.....	3.40	
Peoria	113	64	87.1	0.60	
San Carlos	113	50	80.0	0.62	
San Simon	.....	.....	.....	1.50	
Vail	.....	.....	.....	0.04	
Georgia.					
Lumpkin	96	48	76.4	0.83	
Illinois.					
Albion	102	28	68.4	2.72	
Kansas.					
Abilene	105	33	69.8	1.18	
Maine.					
Bar Harbor	78	28	56.5	3.80	
Minnesota.					
Camden	92	30	61.2	0.14	
Missouri.					
Pickering *[3]	106	25	62.3	0.78	
Nebraska.					
Valparaiso	.....	.....	.....	0.30	
New Hampshire.					
Warner	.....	.....	.....	4.86	
New Mexico.					
Shattucks Ranch	96	51	72.9	2.25	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York.	°	°	°	*Ins*	*Ins*
Cedar Hill	86	33	62.8	6.71	
Ohio.					
Hackney	.....	.....	.....	4.45	
Jacksonburg	105	32	68.9	0.55	
Levering	....	.....	..	3.22	
Rhode Island.					
Bristol	76	45	63.8	7.78	
South Carolina.					
Anderson	.. ...	.....	.....	0.55	
South Dakota.					
Rochford	94	23	54.9	1.53	
Whiteswan	.....	.....	.....	0.25	
Texas.					
Tulia	97	40	69.8	2.96	
Victoria	.....	.....	.....	2.59	
Washington.					
Anacortes	.....	.....	.....	0.96	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[9] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[5] a" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTION.

The following changes have been made in the names of stations:

South Dakota, Montrose, changed to Hartman. The observations formerly accredited to Chandler, S. Dak., are now published as having been made at Academy, that place being the post office address of the observer.

TABLE III.—*Mean temperature for each hour of seventy-fifth meridian time, October*, 1899.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midn't.	Mean.
Bismarck, N Dak....	40.0	39.1	37.8	37.5	36.4	36.3	35.5	35.3	35.9	38.5	41.8	45.3	47.9	50.5	51.8	52.6	52.9	52.1	49.6	46.6	44.5	43.0	41.8	40.4	43.0
Boston, Mass	51.1	50.6	50.1	49.9	49.5	49.3	49.7	51.2	52.8	54.9	56.5	58.0	58.6	58.7	58.7	57.7	57.0	56.1	55.1	54.3	53.5	52.9	52.2	51.9	53.8
Buffalo, N. Y.....	53.1	52.8	52.4	52.1	51.8	51.8	52.0	52.7	54.6	56.4	58.2	59.8	60.5	60.8	60.7	60.3	59.4	58.0	56.8	55.9	54.8	54.3	53.9	53.5	55.7
Cedar City, Utah....	45.2	44.4	43.5	42.7	42.2	41.1	40.7	40.5	39.6	43.2	46.6	49.9	52.0	54.3	55.7	56.7	57.3	56.9	55.3	52.9	49.9	48.4	47 2	46.1	48.0
Chicago, Ill.....	56.4	55.7	54.9	54.5	53.5	52.9	52.7	53.5	54.6	56.1	57.9	59.9	61.1	62.1	62.2	62.2	62.0	61.1	60.2	59.5	58.7	58.2	57.5	57.0	57.7
Cincinnati, Ohio....	56.6	55.7	54.5	53.7	52.7	52.2	51.7	53.0	55.0	57.8	61.7	64.8	67.0	68.5	69.4	69.8	69.6	68.3	66.1	64.5	62.4	60.8	59.2	58.0	60.5
Cleveland, Ohio	53.9	53.5	52.9	52.6	52.1	51.8	51.4	52.2	54.3	57.3	60.2	61.5	62.9	63.0	62.7	62.5	62.2	61.4	60.1	58.8	57.4	56.6	55.5	54.8	57.1
Detroit, Mich.....	52.6	51.9	51.6	51.0	50.7	50.5	50.1	50.5	52.3	54.5	57.1	58.9	60.4	61.3	61.5	61.6	61.1	60.2	58.3	56.4	55.3	54.7	54.1	53.2	55.4
Dodge, Kans.....	53.4	52.4	51.3	50.8	50.3	49.1	48.2	47.8	49.8	54.3	59.3	63.5	66.8	69.3	71.1	72.1	72.3	71.2	67.6	62.8	59.5	57.5	55.8	54.3	58.8
Eastport, Me.....	46.3	45.9	45.6	45.4	44.9	44.8	44.8	45.7	47.3	48.6	49.9	51.0	52.2	52.6	52.3	52.2	51.0	50.0	49.4	48.6	47.8	47.3	46.7	46.4	48.2
Galveston, Tex.....	73.6	73.3	73.1	72.7	72.4	72 0	71.7	71.5	72.2	73.6	75.2	76.2	76.6	77.2	77.4	77.5	77.1	76.4	75.2	74.7	74.5	74.3	74.0	73.8	74.4
Havre, Mont.....	38.0	37.6	36.8	36.3	35.6	35.2	34.3	33.5	33.1	34.4	36.8	39.9	43.2	45.2	47.3	48.5	49.4	49.9	48.7	45.7	43.3	41.6	39.8	38.3	40.5
Independence, Cal..	55.0	53.8	52.1	51.3	50.0	49.2	48.8	47.8	46.1	47.9	51.6	55.4	57.1	61.5	63.9	65.2	65.9	65.6	64.2	62.6	59.3	58.0	56.5	55.3	56.0
Kalispell, Mont	38.3	37.4	37.0	36.5	36.1	35.5	35.0	35.0	34.3	35.2	37.8	40.1	43.1	45.1	46.8	47.8	48.9	48.6	47.2	45.2	42.5	41.0	39.8	39.0	40.6
Kansas City, Mo.....	60.8	59.2	58.2	57.3	56.2	55.4	54.9	54.5	56.7	60.0	64.1	67.5	69.4	71.2	72.5	73.4	73.4	72.5	70.4	68.4	66.0	64.5	62.9	61.6	63.8
Key West, Fla.....	77.1	77.1	76.7	76.5	76.7	76.5	76.6	77.3	78.1	78.5	79.3	79.5	79.9	80.0	80.1	80.0	79.4	78.7	78.3	78.6	77.8	77.8	77.3	76.8	78.1
Marquette, Mich	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Memphis, Tenn.....	63.2	62.2	61.1	60.2	59.3	58.4	58.0	58.6	62.5	65.6	68.5	71.0	72.7	73.8	74.7	75.4	75.1	73.5	71.9	70.5	68.1	66.8	75.7	64.6	66.7
Mt. Tamalpais, Cal..	54.6	54.5	54.2	54.2	54.1	53.8	53.5	53.2	52.6	52.0	52.6	53.1	54.3	55.3	57.2	58.1	59.0	58.4	57.0	55.9	54.8	54.7	54.6	54.5	54.8
New Orleans, La.....	67.5	67.1	66.5	66.1	65.8	65.6	65.6	66.2	67.3	69.7	72.7	74.3	76.2	76.7	77.1	77.3	76.8	75.5	73.1	71.9	70.4	69.5	68.8	68.0	70.6
New York, N. Y.....	55.5	54.8	54.2	54.0	53.5	53.7	53.8	54.7	55.6	57.2	59.3	61.0	62.0	62.5	62.8	62.5	61.0	60.0	59.2	58.6	57.8	57.3	57.0	56.5	57.7
Philadelphia, Pa.....	54.9	54.2	53.8	53.5	53.2	52.8	53.0	54.8	55.7	57.8	59.8	61.6	63.2	64.7	65.2	64.8	63.7	62.5	60.7	59.6	58.5	57.6	56.6	56.0	58.3
Pittsburg, Pa.....	54.3	53.5	52.8	51.9	51.2	50.8	50 5	51.7	52.9	56.0	59.8	62.8	65.6	67.3	68.5	68.9	68.8	67.0	65.1	62.7	60.5	58.5	57.0	56.1	58.9
Portland, Oreg.....	51.1	50.4	49.3	48.2	47.6	47.2	46.6	47.0	46.2	45.9	46.3	48.2	50.1	51.7	53.6	54.9	56.2	56.8	56.6	56.2	55.1	53.7	52.7	51.9	51.0
St. Louis, Mo.....	60.0	59.1	58.3	57.6	57.0	56.5	56.1	56.2	57.4	60.6	64.4	67.5	69.5	71.0	71.8	72.3	72.0	70.0	68.5	66.9	65.2	63.6	62.3	61.1	63.5
St. Paul, Minn.....	49.7	48.6	47.4	46.8	46.2	45.6	45.1	44.7	45.0	47.3	50.3	53.0	55.7	57.1	58.6	59.5	59.6	58.9	57.0	54.9	53.5	52.3	51.2	50.3	51.6
Salt Lake City, Utah.	47.4	46.0	45.5	45.3	45.4	44.8	43.7	44.3	43.9	44.1	47.0	50.3	51.8	54.4	54.9	55.3	55.5	55.8	54.5	52.4	50.2	48.9	47.7	46.4	49.0
San Diego, Cal.....	60.6	60.1	59.6	59.2	59.0	58.7	58.3	57.7	57.8	58.3	60.5	63.0	65.1	66.3	66.6	67.0	66.6	66.8	66.1	64.7	63.6	62.7	61.7	61.3	62.2
San Francisco, Cal...	57.1	56.0	55.5	55.2	55.1	54.6	54.4	55.2	54.2	54.2	55.9	57.8	59.7	61.2	62.1	63.9	64.3	63.8	62.4	60.7	59.5	58.7	58.0	57.5	58.2
Santa Fe, N. Mex ...	47.8	46.9	45.5	45.3	44.2	43.5	42.1	41.8	41.5	46.2	49.5	51.8	53.9	55.2	56.8	57.7	58.5	58.4	56.7	53.1	50.9	49.7	48.7	47.7	49.7
Savannah, Ga.....	64.3	63.5	63.1	62.6	62.4	62.0	62.1	63.4	66.5	69.3	71.6	72.9	73.9	74.4	74.1	73.6	72.1	69.7	68.3	67.6	66.9	66.1	65.5	65.0	67.5
Washington, D. C....	52.6	52.3	51.5	51.1	50.8	50.5	50.5	52.9	56.4	58.8	61.5	63.5	65.1	66.1	66.8	66.5	65.3	62.9	60.1	58.3	57.4	56.2	55.3	54.4	57.8
West Indies.																									
Basseterre, St. Kitts.	77.0	76.9	76.9	76.7	76.9	79.1	81.3	82.1	83.5	83.8	84.3	84.8	84.3	83.6	82.5	81.5	79.9	79.1	78.6	79.0	78.3	77.8	77.9	77.4	80.1
Bridgetown, Bar.....	76.2	76.1	76.0	75.8	75.8	77.8	81.8	83.3	84.4	85.1	84.9	84.8	84.9	84.3	83.2	81.9	89.6	79.5	78.7	77.9	77.4	77.1	76.8	76.5	80.0
Cienfuegos, Cuba ...	74.3	73.6	73.6	73.2	72.8	72.5	73.8	76.4	79.0	81.0	82.3	83.5	84.5	83.8	82.5	82.0	80.2	78.9	77.5	76.6	75.9	75.2	74.6	74.3	77.6
Havana, Cuba.....	76.3	75.5	75.5	75.1	75.0	75.1	76.0	77.5	79.7	80.2	81.8	82.0	81.5	81.2	81.2	80.8	80.3	79.7	79.1	79.1	78.6	78.0	77.2	76.6	78.5
Kingston, Jamaica..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port of Spain, Trin..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
P. Principe, Cuba ...	72.3	71.6	71.3	70.9	70.8	70.8	73.3	76.8	79.4	81.3	82.7	83.8	84.6	83.8	82.3	81.3	80.6	78.1	76.6	75.4	74.6	73.9	73.4	72.8	76.8
San Juan, P. R.....	75.5	75.5	75.2	75.0	75.0	75.6	77.3	79.7	81.7	83.0	83.2	83.4	83.0	82.6	81.1	80.3	79.4	78.6	78.0	77.7	76.9	76.6	76.2	75.8	78.6
Santiago de Cuba...	74.4	74.1	73.6	73.5	73.5	73.5	75.3	77.3	81.1	82.8	83.9	84.3	84.5	83.6	81.9	80.1	79.1	78.2	77.6	76.9	76.1	75.7	75.4	74.7	78.0
Santo Domingo, S. D.	73.5	73.0	72.6	72.1	71.7	71.5	73.5	76.9	79.7	81.4	82.4	82.6	82.6	82.6	81.7	81.1	80.0	78.9	77.5	77.0	76.1	75.3	74.7	74.2	77.2
Willemstad, Curaçao	79.8	79.5	79.4	79.2	79.2	79.1	81.1	82.5	83.1	83.4	84.0	84.6	84.8	85.8	85.9	85.1	83.0	82.1	81.5	81.5	81.1	80.9	80.6	80.3	82.0

TABLE IV.—*Mean pressure for each hour of seventy-fifth meridian time, October*, 1899.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midn't.	Mean.
Bismarck, N. Dak....	28.224	.227	.230	.231	.233	.235	.240	.243	.251	.259	.255	.247	.235	.222	.208	.201	.201	.203	.210	.216	.224	.237	.246	.248	.230
Boston, Mass.....	30.079	.076	.074	.074	.080	.086	.096	.103	.103	.099	.091	.075	.063	.055	.050	.050	.052	.058	.062	.068	.070	.068	.067	.066	.074
Buffalo, N. Y.....	29.348	.351	.352	.354	.361	.366	.374	.381	.387	.385	.379	.365	.348	.335	.328	.323	.322	.326	.329	.328	.329	.328	.328	.328	.348
Cedar City, Utah....	24.253	.254	.255	.258	.255	.252	.255	.258	.267	.273	.283	.288	.285	.274	.260	.243	.233	.228	.228	.228	.234	.241	.249	.254	.254
Chicago, Ill.....	29.241	.243	.243	.246	.252	.256	.262	.271	.275	.274	.272	.265	.248	.234	.225	.216	.210	.210	.212	.211	.219	.221	.223	.224	.240
Cincinnati, Ohio	29.490	.492	.490	.491	.498	.506	.516	.520	.532	.529	.519	.506	.482	.470	.454	.449	.447	.449	.458	.460	.467	.469	.472	.470	.485
Cleveland, Ohio	29.343	.343	.344	.348	.355	.362	.368	.375	.379	.375	.368	.359	.342	.329	.321	.315	.314	.317	.323	.324	.324	.324	.322	.320	.341
Detroit, Mich.....	29.368	.368	.369	.368	.371	.377	.382	.394	.402	.402	.396	.387	.370	.358	.348	.344	.340	.345	.347	.349	.354	.352	.351	.349	.366
Dodge, Kans	27.397	.398	.400	.395	.395	.399	.404	.402	.410	.421	.422	.413	.397	.377	.354	.339	.335	.335	.343	.364	.379	.388	.399	.405	.386
Eastport, Me	30.106	.098	.099	.102	.108	.115	.125	.131	.130	.126	.119	.111	.101	.093	.088	.087	.091	.097	.101	.107	.108	.106	.101	.099	.106
Galveston, Tex.....	29.948	.947	.944	.940	.942	.948	.956	.965	.979	.988	.989	.982	.965	.943	.926	.916	.910	.910	.918	.929	.937	.946	.949	.945	.947
Havre, Mont.....	27.329	.330	.328	.330	.329	.329	.332	.332	.337	.345	.349	.352	.347	.340	.328	.323	.319	.318	.325	.328	.337	.342	.350	.351	.335
Independence, Cal..	25.961	.964	.970	.972	.970	.970	.974	.977	.985	.988	.995	.999	.000	.984	.964	.944	.934	.927	.923	.921	.924	.933	.947	.962	.962
Kalispell, Mont	26.919	.919	.919	.920	.919	.918	.922	.923	.930	.938	.943	.947	.940	.929	.916	.910	.906	.906	.908	.911	.919	.926	.933	.934	.923
Kansas City, Mo.....	29.025	.029	.033	.031	.035	.041	.049	.058	.066	.068	.068	.065	.056	.041	.016	.998	.988	.982	.989	.998	.007	.015	.022	.023	.026
Key West, Fla.....	29.902	.895	.890	.889	.893	.901	.916	.924	.937	.940	.935	.919	.898	.879	.872	.868	.870	.875	.885	.903	.911	.915	.913	.908	.902
Marquette, Mich ...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Memphis, Tenn.....	29.670	.672	.672	.671	.676	.685	.696	.705	.718	.722	.719	.713	.687	.667	.648	.639	.634	.634	.638	.643	.650	.657	.660	.661	.672
Mt. Tamalpais, Cal .	27.536	.536	.533	.534	.526	.517	.516	.517	.523	.529	.547	.555	.561	.559	.553	.543	.535	.532	.528	.523	.522	.529	.535	.540	.535
New Orleans, La.....	29.986	.983	.979	.975	.979	.986	.997	.011	.020	.024	.019	.010	.991	.970	.956	.948	.946	.951	.959	.964	.977	.984	.985	.981	.983
New York, N. Y.....	29.880	.877	.874	.874	.880	.885	.892	.899	.903	.899	.889	.875	.860	.849	.842	.839	.840	.845	.851	.855	.860	.861	.861	.859	.869
Philadelphia, Pa.....	30.101	.095	.091	.092	.097	.104	.113	.121	.125	.121	.111	.098	.082	.072	.063	.062	.062	.067	.074	.078	.083	.083	.079	.078	.090
Pittsburg, Pa.....	29.280	.279	.278	.282	.288	.297	.306	.314	.317	.314	.307	.294	.270	.250	.241	.236	.233	.238	.244	.250	.257	.258	.258	.253	.273
Portland, Oreg.....	29.878	.882	.882	.884	.884	.879	.876	.879	.884	.890	.896	.904	.908	.904	.895	.886	.876	.871	.867	.862	.864	.869	.876	.883	.883
St. Louis, Mo.....	29.485	.484	.486	.484	.486	.492	.496	.503	.514	.517	.513	.505	.489	.466	.449	.443	.439	.440	.445	.454	.462	.469	.473	.473	.478
St. Paul, Minn.....	29.106	.111	.115	.117	.119	.126	.132	.133	.142	.145	.143	.137	.124	.110	.093	.085	.082	.085	.088	.092	.094	.096	.102	.112	.112
Salt Lake City, Utah.	25.615	.613	.615	.618	.615	.617	.621	.628	.636	.648	.654	.660	.654	.645	.628	.618	.612	.611	.607	.606	.612	.618	.623	.625	.625
San Diego, Cal.....	29.861	.856	.857	.854	.849	.842	.844	.849	.857	.869	.881	.885	.882	.876	.859	.847	.837	.833	.829	.831	.838	.848	.855	.864	.854
San Francisco, Cal...	29.841	.841	.841	.843	.840	.834	.835	.838	.844	.852	.866	.877	.878	.875	.866	.852	.840	.832	.825	.820	.825	.834	.841	.846	.845
Santa Fe, N. Mex ...	23.288	.289	.289	.287	.282	.283	.286	.292	.299	.308	.314	.314	.309	.298	.275	.264	.257	.253	.254	.257	.264	.270	.279	.283	.283
Savannah, Ga.....	30.015	.010	.004	.001	.007	.015	.025	.035	.046	.046	.040	.029	.010	.996	.987	.985	.986	.992	.996	.003	.008	.010	.007	.002	.011
Washington, D. C....	30.095	.092	.084	.084	.087	.095	.102	.113	.118	.117	.111	.097	.078	.063	.052	.045	.046	.049	.053	.059	.062	.063	.063	.062	.079
West Indies.																									
Basseterre, St. Kitts.	29.848	.836	.830	.832	.845	.861	.879	.888	.895	.888	.871	.851	.836	.828	.836	.831	.840	.850	.866	.878	.881	.877	.871	.860	.857
Bridgetown, Bar....	29.817	.813	.816	.824	.835	.848	.862	.875	.875	.863	.843	.824	.804	.796	.798	.805	.812	.822	.838	.853	.857	.856	.847	.835	.834
Cienfuegos, Cuba...	29.799	.790	.775	.772	.778	.792	.806	.819	.829	.829	.824	.806	.782	.767	.759	.758	.766	.777	.791	.808	.820	.823	.818	.809	.796
Havana, Cuba.....	29.841	.832	.821	.820	.827	.836	.849	.856	.870	.873	.869	.856	.834	.821	.812	.807	.812	.821	.831	.839	.858	.860	.856	.849	.840
Kingston, Jamaica..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port of Spain, Trin..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
P. Principe, Cuba ...	29.487	.476	.466	.466	.474	.486	.498	.516	.520	.519	.508	.487	.465	.448	.441	.444	.452	.468	.485	.502	.508	.509	.505	.499	.485
San Juan, P. R.....	29.796	.784	.778	.780	.787	.801	.816	.830	.835	.829	.815	.794	.776	.768	.768	.773	.779	.789	.803	.819	.825	.825	.819	.808	.800
Santiago de Cuba...	29.746	.738	.729	.730	.739	.748	.765	.770	.782	.778	.764	.743	.718	.705	.701	.705	.715	.724	.737	.749	.766	.768	.764	.757	.743
Santo Domingo, S. D.	29.819	.806	.799	.798	.810	.826	.843	.857	.868	.862	.846	.822	.800	.784	.775	.778	.788	.800	.818	.834	.845	.848	.843	.831	.821
Willemstad, Curaçao	29.746	.737	.729	.732	.745	.762	.781	.794	.802	.798	.770	.745	.707	.684	.667	.669	.682	.699	.732	.753	.772	.775	.773	.764	.742

TABLE V.—*Average wind movement for each hour of seventy-fifth meridian time, October, 1899.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex.	9.7	9.5	9.5	9.3	9.0	9.1	8.4	7.8	7.8	9.3	11.9	12.4	13.7	13.3	13.3	13.1	12.7	12.2	11.7	9.6	8.7	8.6	9.3	9.3	10.4
Albany, N. Y.	4.6	4.7	4.6	4.3	4.9	4.8	5.1	5.6	6.5	7.7	8.5	8.6	8.8	8.9	8.8	7.9	7.5	6.3	5.6	5.5	5.4	5.5	4.7	4.9	6.2
Alpena, Mich.	6.6	6.9	6.8	6.8	7.4	7.6	7.2	7.7	8.5	9.0	9.3	10.2	11.6	11.3	11.3	10.8	10.6	8.8	8.2	8.1	7.7	7.4	7.3	7.4	8.5
Amarillo, Tex.	15.4	16.3	16.9	16.7	16.4	16.0	16.4	15.4	15.2	16.8	18.9	18.6	18.6	17.9	17.4	17.5	17.2	17.1	15.7	12.8	13.1	15.3	16.0	15.5	16.4
Atlanta, Ga.	9.1	10.3	10.3	9.9	10.0	10.3	10.4	10.6	10.4	10.3	11.2	10.9	11.3	10.4	10.1	10.1	10.0	8.7	8.5	9.5	10.1	10.1	10.2	8.7	10.1
Atlantic City, N. J.	8.6	8.9	8.7	8.5	9.1	9.2	9.0	9.3	11.1	11.9	11.5	11.2	11.7	11.6	11.2	11.0	10.5	9.5	9.4	9.3	9.1	9.2	9.1	8.6	9.9
Augusta, Ga.	5.0	5.1	5.3	5.9	6.1	5.7	5.9	6.0	7.1	8.0	8.5	8.4	8.6	8.4	8.4	7.8	7.4	6.2	5.6	5.5	5.2	5.2	5.0	5.0	6.5
Baker City, Oreg.	4.6	5.1	5.4	5.6	5.8	5.7	5.9	5.8	6.0	6.2	5.3	5.3	4.8	4.7	5.6	6.4	6.3	6.4	6.6	5.5	4.0	4.1	4.5	4.9	5.4
Baltimore, Md.	3.5	3.6	3.5	3.7	3.8	3.9	3.6	4.0	4.8	5.7	5.8	5.8	6.4	6.3	6.4	6.3	5.8	4.7	4.0	3.7	3.8	3.8	3.6	3.8	4.6
Bismarck, N. Dak.	6.9	6.2	6.1	6.7	7.3	7.2	6.6	6.7	7.0	8.0	9.9	10.1	10.9	11.4	11.4	12.0	11.7	10.5	8.5	7.3	6.9	7.1	7.0	6.7	8.3
Block Island, R. I.	15.2	14.9	14.4	14.6	14.4	14.6	14.0	14.5	14.8	15.7	15.6	15.9	16.4	16.2	15.9	16.7	17.0	16.5	16.4	16.6	15.6	16.1	16.2	15.8	15.6
Boise, Idaho.	3.7	3.2	3.2	3.5	3.3	3.3	2.9	3.0	2.9	2.9	3.3	4.0	4.8	5.9	6.0	5.7	6.5	6.1	6.1	4.9	3.6	3.5	3.3	3.5	4.1
Boston, Mass.	9.1	8.6	8.2	8.8	8.3	8.1	8.4	8.7	9.3	10.0	10.5	9.9	10.3	10.1	10.5	9.7	9.1	8.9	8.9	9.2	8.7	9.0	8.7	8.5	9.1
Buffalo, N. Y.	10.6	10.8	10.7	10.4	10.6	10.7	10.9	11.2	10.8	10.7	11.4	11.2	11.5	12.1	12.0	11.4	11.0	10.6	8.9	7.4	5.6	5.2	5.3	5.4	9.1
Cairo, Ill.	5.3	5.1	5.1	5.5	5.9	5.6	6.3	6.2	6.8	8.2	8.3	8.2	8.6	9.3	9.1	8.5	7.9	6.8	5.8	5.7	5.4	5.2	5.3	5.4	6.6
Cape Henry, Va.	12.9	13.9	14.1	14.0	13.7	13.3	12.8	13.0	12.8	13.2	13.2	12.4	13.4	13.9	14.1	14.6	14.3	13.4	13.0	12.9	12.4	12.4	13.1	12.9	13.3
Carson City, Nev.	5.2	5.3	4.9	4.8	5.1	4.5	4.2	4.4	4.5	5.3	4.6	4.6	5.4	5.5	6.6	7.2	8.1	9.0	9.0	9.3	6.9	6.3	5.8	5.9	5.9
Cedar City, Utah.	6.6	6.2	6.1	5.9	5.8	5.8	6.1	6.3	5.3	5.1	4.8	5.4	7.1	8.1	8.6	8.9	8.9	8.9	8.5	7.2	6.1	6.1	6.6	6.4	6.7
Charleston, S. C.	11.6	11.9	12.4	12.6	13.2	13.2	13.0	13.1	13.4	13.8	14.3	14.5	15.4	16.4	16.8	16.5	15.2	12.5	10.9	11.1	11.9	12.1	12.0	11.2	13.3
Charlotte, N. C.	6.2	6.6	6.2	6.5	6.2	6.6	6.2	6.3	6.9	7.9	8.3	7.6	7.5	7.4	6.8	6.5	6.7	5.8	5.2	5.0	5.5	6.3	6.2	6.4	6.5
Chattanooga, Tenn.	3.2	3.6	3.8	3.6	3.5	3.9	4.3	4.3	5.4	6.5	6.5	7.1	8.2	7.9	7.3	7.1	6.9	6.0	5.2	4.4	4.0	3.4	3.3	3.3	5.1
Cheyenne, Wyo.	8.7	8.3	9.7	9.2	9.9	8.6	9.0	8.4	8.1	7.9	9.3	10.8	12.6	13.1	12.5	12.8	15.2	11.5	10.2	8.6	7.5	7.6	8.0	8.3	9.7
Chicago, Ill.	17.9	18.3	17.5	17.6	17.4	17.2	17.5	17.7	17.6	17.7	17.6	17.3	18.0	18.0	18.2	18.8	18.6	16.5	16.8	17.0	16.7	17.7	18.1	17.7	17.6
Cincinnati, Ohio.	4.5	4.5	4.2	4.3	3.9	4.2	4.3	4.8	5.2	6.3	6.5	7.9	8.6	8.1	8.3	8.0	7.8	7.2	6.2	5.5	5.0	5.0	5.0	4.6	5.8
Cleveland, Ohio.	12.3	12.5	12.8	12.2	12.5	12.4	12.8	13.7	13.0	12.8	12.6	12.1	11.1	11.9	12.8	12.0	11.9	11.8	11.6	12.0	12.2	12.7	13.1	12.6	12.4
Columbia, Mo.	7.6	7.6	6.9	6.5	6.7	6.8	6.5	6.1	6.4	7.0	7.9	8.3	9.2	9.0	9.3	9.1	8.9	8.1	6.6	7.0	7.5	8.0	8.0	7.7	7.6
Columbus, Ohio.	5.4	5.4	5.3	5.1	5.1	4.9	5.2	5.2	6.4	7.1	8.1	7.9	8.0	8.4	8.9	8.9	7.5	6.1	6.1	6.7	6.6	6.4	6.0	5.5	6.4
Concordia, Kans.	7.4	7.6	8.0	7.8	7.7	7.5	7.2	7.2	7.5	9.0	10.2	11.0	10.9	11.2	10.9	11.1	11.1	10.1	7.4	6.7	6.8	7.3	7.6	7.7	8.6
Corpus Christi, Tex.	11.8	10.3	9.7	9.1	8.7	8.4	8.8	9.1	8.3	9.2	10.1	10.4	11.3	12.7	13.4	14.3	14.2	13.6	12.8	12.9	12.6	12.7	11.9	11.4	11.2
Davenport, Iowa.	7.1	6.4	6.2	6.2	6.1	6.1	6.1	5.9	6.2	7.5	8.3	8.0	8.9	9.2	9.5	9.4	9.2	8.2	6.8	7.1	7.0	7.0	6.9	6.9	7.3
Denver, Colo.	6.7	7.7	7.1	6.5	6.5	6.3	7.0	6.9	7.5	7.1	6.5	7.4	7.9	8.6	8.7	9.2	9.1	9.6	9.5	7.5	6.3	6.2	6.1	6.9	7.4
Des Moines, Iowa.	7.2	6.9	7.1	7.0	7.0	6.7	5.9	6.0	6.8	8.1	8.0	8.2	9.1	12.0	9.9	10.9	10.1	10.8	8.8	7.6	8.4	8.5	8.6	7.9	8.9
Detroit, Mich.	7.3	7.4	7.3	7.1	7.1	7.0	7.2	7.4	7.5	8.1	8.0	8.2	9.1	9.9	10.9	10.1	9.2	7.9	7.5	7.9	7.9	7.8	8.0	7.7	8.1
Dodge, Kans.	10.5	10.2	10.7	11.3	11.3	11.2	10.4	10.8	11.5	14.0	15.3	14.8	15.4	15.4	15.5	15.4	14.5	12.0	10.3	7.9	7.6	8.2	8.0	7.8	12.4
Dubuque, Iowa.	6.4	6.3	6.5	6.2	6.1	5.5	5.6	5.4	5.7	6.8	8.0	9.0	9.8	10.0	10.0	10.2	8.7	7.5	7.9	7.6	8.2	8.9	10.4	10.4	7.6
Duluth, Minn.	9.1	9.2	9.2	8.9	8.7	8.8	9.2	9.0	8.5	8.6	9.6	10.1	11.0	10.5	10.9	11.2	10.9	10.0	9.2	9.4	9.7	10.1	9.8	10.0	9.7
Eastport, Me.	8.5	8.7	8.5	9.1	8.9	9.5	9.6	10.1	10.6	10.9	10.5	10.2	10.4	10.7	10.7	9.6	8.3	8.0	8.6	8.7	8.6	8.7	8.7	9.5	9.4
Elkins, W. Va.	1.5	1.5	1.5	1.8	1.6	2.0	1.9	1.8	2.3	3.3	3.7	4.4	5.3	5.2	5.1	5.3	5.1	4.4	2.7	2.1	2.0	1.8	1.9	1.5	2.9
El Paso, Tex.	10.0	9.9	10.3	9.2	8.5	8.5	7.9	8.0	8.5	8.5	9.4	10.6	11.3	12.2	12.5	13.5	13.8	13.3	12.2	10.4	8.5	9.0	10.0	9.6	10.2
Erie, Pa.	10.3	10.7	10.9	10.6	10.7	10.2	10.0	9.7	10.0	9.5	9.4	9.5	9.6	9.5	9.5	9.0	8.0	7.3	7.7	8.2	6.5	7.6	9.5	10.1	9.4
Escanaba, Mich.	7.8	7.8	7.9	8.2	8.5	8.7	8.6	8.8	9.1	9.4	9.5	10.5	10.1	10.4	10.6	11.0	10.5	9.4	9.1	9.4	8.9	9.3	9.1	8.6	9.9
Eureka, Cal.	4.4	3.7	3.4	3.6	3.9	3.6	3.5	4.4	3.9	3.8	3.4	3.4	4.4	5.7	6.5	7.6	9.1	9.7	9.6	8.5	7.3	6.2	5.5	5.0	6.5
Evansville, Ind.	4.5	4.3	4.2	4.3	4.3	4.5	4.8	5.0	6.0	7.1	8.0	8.2	8.1	8.0	8.1	7.4	9.4	9.6	9.5	8.5	7.3	5.6	5.1	4.9	5.4
Fort Canby, Wash.	15.5	15.0	14.5	13.5	13.4	14.2	14.3	12.8	12.1	12.2	12.6	12.6	13.0	13.1	13.0	13.2	14.4	14.6	15.4	15.4	14.8	15.6	15.5	13.9	13.9
Fort Smith, Ark.	6.1	5.8	6.4	6.6	6.8	5.9	5.9	6.3	6.0	6.4	7.0	7.6	8.2	8.7	9.0	8.7	8.8	7.0	6.4	6.3	7.0	6.8	5.6	5.1	7.0
Fresno, Cal.	4.0	3.7	4.2	4.0	4.1	3.7	4.0	3.8	4.0	4.0	4.3	4.9	5.8	5.7	5.6	6.1	5.8	5.6	5.7	5.4	4.0	4.1	4.0	4.2	4.6
Galveston, Tex.	9.4	9.5	9.5	9.3	9.3	9.0	8.7	8.5	9.2	10.0	10.3	10.3	10.3	10.4	10.2	9.6	9.1	8.9	8.6	8.8	8.6	8.9	9.1	9.4	
Grand Haven, Mich.	7.6	7.7	8.0	8.2	8.2	8.1	8.0	8.5	9.4	10.1	11.2	10.5	11.4	11.6	11.2	10.8	10.3	8.2	7.2	7.4	8.6	8.9	8.0	7.7	9.0
Grand Junction, Colo.	3.9	4.4	4.7	5.0	4.7	4.7	4.0	4.0	4.3	4.6	5.5	5.8	5.3	5.2	5.1	5.3	5.5	4.7	4.0	3.5	3.7	3.5	3.6	3.7	4.6
Green Bay, Wis.	6.8	6.8	6.5	6.5	6.5	6.8	6.7	6.5	6.9	8.2	8.8	8.9	9.6	10.3	9.8	8.9	8.5	7.6	7.3	7.7	7.5	7.5	7.7	7.7	7.8
Hannibal, Mo.	9.0	8.3	7.5	7.5	7.0	7.3	7.2	6.5	7.0	8.7	10.2	10.3	11.1	11.5	11.1	11.4	10.4	9.4	7.9	8.2	9.0	8.7	9.2	9.2	8.9
Harrisburg, Pa.	4.1	3.6	3.5	3.7	3.9	3.8	3.7	4.4	4.9	5.5	6.0	6.3	6.4	6.4	6.1	5.5	4.4	3.9	3.9	3.6	3.3	3.7	4.0	4.6	
Hatteras, N. C.	11.9	11.9	11.5	12.0	12.7	12.5	12.0	12.6	13.0	13.4	14.1	14.2	14.3	14.6	14.4	14.4	13.8	12.5	12.5	12.6	12.8	13.0	12.1	13.0	
Havre, Mont.	7.9	8.0	7.8	8.2	8.9	9.0	9.3	9.3	9.0	9.5	9.9	11.3	12.3	12.3	12.8	13.0	12.0	10.6	8.9	8.1	7.3	7.9	8.4	9.7	
Helena, Mont.	7.4	7.3	7.2	6.4	5.8	5.3	5.7	6.1	5.4	5.3	5.3	5.4	6.5	7.1	7.1	7.7	8.2	7.5	7.4	8.8	8.4	7.4	7.3	6.9	
Huron, S. Dak.	9.0	9.5	9.6	9.1	8.5	8.7	8.8	9.8	9.2	9.4	10.6	10.6	10.6	11.5	12.0	12.5	12.5	12.2	10.6	9.5	9.9	9.4	9.6	9.5	10.1
Independence, Cal.	9.0	8.6	8.8	8.6	8.5	8.6	8.4	7.9	7.9	7.4	7.1	7.5	8.6	10.3	9.6	9.9	10.1	10.3	10.6	9.6	9.9	9.3	8.1	8.3	8.8
Indianapolis, Ind.	8.5	7.9	7.4	7.5	7.3	7.2	7.7	7.7	8.4	9.7	10.6	11.5	11.3	11.7	11.6	11.2	9.8	10.0	9.0	9.0	9.4	9.1	8.8	8.6	9.2
Jacksonville, Fla.	7.1	7.0	7.2	7.2	7.2	7.1	6.7	7.0	7.5	9.7	11.7	11.6	12.3	12.7	12.2	11.6	10.0	8.4	8.2	8.1	8.2	7.3	7.3	8.4	8.9
Jupiter, Fla.	13.3	14.2	14.5	15.0	14.6	14.7	14.1	15.0	15.0	15.5	15.4	15.2	14.5	15.7	15.2	15.3	15.1	14.4	14.6	14.5	14.8	14.5	14.0	14.8	
Kalispell, Mont.	4.8	5.0	4.9	4.8	4.6	4.4	4.7	4.5	4.7	4.6	4.5	4.4	5.1	5.8	6.8	7.6	7.7	7.2	6.5	5.5	5.6	5.8	5.4	4.9	5.4
Kansas City, Mo.	8.8	8.8	8.8	8.6	8.1	7.8	7.4	7.2	7.9	9.4	10.6	11.3	12.4	12.0	12.1	11.7	11.3	10.4	8.8	8.0	8.1	8.4	8.3	8.4	9.4
Keokuk, Iowa.	7.8	7.3	7.0	6.3	6.6	6.0	6.2	5.6	6.0	7.5	8.1	8.9	8.9	8.7	9.2	9.5	9.0	7.7	7.0	6.8	7.2	7.5	7.6	7.7	7.5
Key West, Fla.	15.5	15.7	15.5	14.3	14.9	15.1	15.5	15.5	15.7	15.3	15.3	15.1	15.7	15.2	15.9	15.2	15.5	15.1	15.2	15.7	15.7	15.8	14.5	15.3	
Kittyhawk, N. C.	16.3	16.4	15.4	14.3	14.6	14.9	15.1	15.4	15.8	16.5	16.5	16.0	16.1	16.7	17.9	18.3	17.5	17.2	17.1	17.5	16.5	16.7	15.7	16.3	
Knoxville, Tenn.	4.8	4.1	4.2	4.3	4.3	4.2	3.8	4.1	4.9	5.0	5.7	6.2	7.1	7.3	7.5	7.5	6.9	6.8	5.6	4.7	4.5	4.4	4.5	4.6	5.3
La Crosse, Wis.	7.1	7.2	6.4	6.9	6.2	6.0	5.5	6.0	6.3	6.8	7.0	8.1	8.4	8.3	8.6	9.1	8.7	8.0	6.9	6.9	7.1	8.0	8.0	7.9	7.3
Lander, Wyo.	3.0	2.9	2.8	3.0	2.5	3.0	3.2	2.7	2.4	3.0	3.9	5.1	6.8	6.5	6.5	6.7	7.0	6.2	5.6	4.4	3.7	3.5	2.7	2.7	4.2
Lexington, Ky.	8.9	8.9	9.0	9.1	8.9	8.8	9.2	9.4	9.2	9.4	9.7	10.1	10.0	10.2	9.4	8.9	7.4	8.2	8.2	8.2	8.6	9.0	9.1	8.6	9.1
Little Rock, Ark.	4.1	4.1	4.5	4.5	4.3	4.9	5.3	5.2	4.8	6.7	6.8	7.5	8.7	9.1	9.3	9.2	7.6	6.1	5.8	5.2	4.6	4.6	4.7	6.1	
Los Angeles, Cal.	3.3	3.0	3.2	2.6	3.0	2.9	3.2	3.4	3.4	3.4	3.7	4.1	4.5	4.9	5.5	6.5	7.5	8.6	8.1	6.7	7.5	8.0	8.0	7.7	7.6
Louisville, Ky.	5.6	6.0	5.8	5.8	6.0	6.0	5.9	6.4	6.5	7.6	7.9	8.3	9.2	9.0	9.2	8.8	8.1	7.1	6.1	6.1	6.7	6.6	6.4	5.5	6.4
Lynchburg, Va.	1.7	1.5	1.5	1.7	1.8	1.5	1.8	2.1	2.6	3.4	4.5	9.2	9.6	9.2	9.6	9.1	8.6	7.4	6.7	6.8	6.8	7.3	7.6	7.7	8.6
Macon, Ga.	5.9	6.4	6.3	6.7	6.5	6.1	5.8	6.8	7.9	8.5	9.1	9.0	9.4	9.1	8.7	8.2	6.1	6.3	6.3	6.6	6.3	6.0	5.8	6.4	7.3
Marquette, Mich.	9.4	9.8	10.3	9.9	9.5	9.5	9.5	10.3	10.5	11.4	11.6	11.4	12.3	12.1	11.7	11.7	10.7	9.1	8.6	9.6	10.5	11.1	10.6	10.4	10.5
Memphis, Tenn.	5.2	5.4	5.6	5.0	4.9	4.9	4.9	4.9	5.5	5.5	5.7	5.1	6.2	6.6	6.8	6.5	6.1	5.3	4.2	4.9	5.6	5.7	5.6	5.0	5.5
Milwaukee, Wis.	11.4	10.6	10.5	10.7	10.5	10.8	10.3	10.3	10.8	11.8	12.3	13.1	13.4	13.6	14.1	13.9	13.3	11.9	10.6	10.8	10.7	10.8	10.8	10.7	11.6
Minneapolis, Minn.	10.0	9.5	9.6	9.0	9.1	8.7	8.9	8.9	8.9	9.4	10.1	10.2	11.2	11.1	11.0	11.5	11.3	10.8	10.8	10.7	10.5	10.5	10.4	10.7	10.1
Mobile, Ala.	5.8	5.5	5.5	5.4	5.9	6.2	6.1	5.9	6.9	7.4	7.8	7.9	9.1	9.5	9.6	10.3	9.8	8.5	7.1	6.5	5.7	6.3	5.8	5.5	7.1
Montgomery, Ala.	5.5	5.0	5.0	5.1	4.5	4.4	4.7	4.8	6.2	7.4	7.6	7.7	8.2	7.9	8.2	8.5	8.0	6.5	5.5	5.7	5.7	5.7	6.3	5.7	6.2
Moorhead, Minn.	8.4	8.1	8.3	7.9	8.2	8.0	8.1	7.8	8.2	8.0	8.8	9.9	10.4	10.9	11.3	11.8	11.5	10.5	8.8	9.3	9.6	9.8	9.4	9.1	9.3
Mount Tamalpais, Cal.	22.3	20.9	20.2	19.9	19.6	20.5	20.9	20.5	19.5	19.7	18.3	16.8	16.5	14.4	12.9	12.2	13.7	15.9	19.1	19.8	19.8	20.0	22.1	18.2	
Nantucket, Mass.	9.9	10.5	10.4	10.3	10.5	10.7	10.3	11.1	11.6	12.1	12.5	12.5	12.6	12.4	12.3	11.0	11.2	10.3	10.4	10.5	10.9	10.7	10.3	11.1	
Nashville, Tenn.	3.8	3.7	3.7	3.6	3.8	3.9	3.7	3.8	4.3	6.5	7.6	7.6	7.6	8.0	8.6	8.6	7.0	5.7	6.1	5.1	4.6	4.5	4.4	5.6	
Neah, Wash.	5.4	5.8	5.5	5.1	5.6	4.9	5.2	5.6	5.3	5.2	5.7	6.2	6.4	7.4	7.3	7.5	7.0	7.5	7.2	6.1	5.4	5.4	5.2	6.1	

TABLE V.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
New Haven, Conn.	6.9	6.7	6.5	6.1	6.1	6.5	7.4	7.6	8.6	9.9	10.1	9.3	10.0	10.9	10.9	9.9	9.2	7.9	7.5	7.1	7.1	6.7	6.7	7.1	8.0
New Orleans, La.	7.3	7.0	7.3	7.0	7.8	7.8	7.7	8.5	9.4	10.5	10.8	10.8	11.7	11.7	11.8	11.3	10.9	9.6	7.8	7.4	7.5	7.6	7.6	7.3	8.9
New York, N. Y.	9.3	9.5	9.2	9.7	9.5	9.7	9.6	10.6	10.8	12.0	11.6	10.5	10.6	11.0	10.9	11.9	12.2	12.3	12.7	12.1	11.4	10.8	9.8	9.3	10.7
Norfolk, Va.	7.7	8.0	7.7	7.6	7.2	7.4	6.8	7.6	7.9	9.5	9.7	10.3	10.9	11.3	10.8	11.4	11.0	9.9	9.2	8.4	8.1	8.2	8.1	8.0	8.9
Northfield, Vt.	5.9	5.8	5.1	5.7	5.9	6.3	6.9	6.7	6.5	8.2	10.2	10.8	11.6	11.2	11.2	10.7	8.7	7.3	6.0	6.2	6.1	6.2	6.3	6.5	7.6
North Platte, Nebr.	6.4	5.8	5.9	6.1	5.9	6.0	5.8	6.4	5.7	5.9	6.3	7.2	7.7	8.8	9.8	10.5	10.5	10.2	8.6	7.6	7.2	7.8	7.3	6.6	7.3
Oklahoma, Okla.	9.4	9.3	9.5	9.9	9.7	9.4	9.2	9.0	9.5	11.2	13.3	14.0	13.9	14.0	14.5	14.8	14.4	12.6	10.5	9.1	8.9	8.8	9.5	9.2	11.0
Omaha, Nebr.	7.5	7.5	7.4	7.5	7.0	7.2	7.0	7.2	7.5	9.0	9.5	10.5	11.6	12.0	12.1	12.1	12.2	10.7	9.1	9.0	9.3	9.0	8.9	8.4	9.1
Oswego, N. Y.	8.2	8.4	8.3	8.6	8.7	9.2	9.4	9.7	10.0	10.0	10.1	10.1	9.6	9.0	8.8	8.5	7.5	7.0	7.2	8.1	8.3	8.2	7.9	7.8	8.7
Palestine, Tex.	5.1	4.8	4.6	4.7	4.6	4.4	4.1	4.2	4.6	6.1	7.8	8.0	8.7	8.3	8.5	8.5	8.1	7.5	5.6	4.5	4.9	5.4	5.3	5.7	6.0
Parkersburg, W. Va.	2.7	2.6	2.6	2.4	2.1	2.5	2.7	2.7	3.5	4.3	5.1	5.6	5.7	5.6	6.0	5.4	4.8	4.0	3.4	2.9	3.0	3.0	2.7	2.8	3.7
Pensacola, Fla.	9.8	10.4	10.6	9.9	10.1	10.3	10.4	10.1	11.0	12.0	12.2	12.2	12.6	12.2	11.8	11.1	10.4	9.1	7.8	7.0	7.5	7.8	8.4	9.4	10.2
Phenix, Ariz.	4.0	3.8	3.4	3.5	3.5	3.5	3.8	3.6	3.8	4.1	4.7	4.9	5.9	5.8	6.0	5.8	5.6	5.5	5.5	3.8	3.6	3.6	3.3	3.4	4.3
Philadelphia, Pa.	7.5	7.4	6.9	7.0	6.7	6.1	6.4	7.5	9.5	9.9	9.9	10.0	10.8	10.4	10.8	10.2	10.3	9.2	8.6	8.1	7.6	7.7	7.9	7.3	8.5
Pierre, S. Dak.	7.6	7.7	7.1	6.4	6.3	6.5	5.9	6.4	6.3	6.8	9.1	9.7	10.4	11.1	11.4	11.0	11.8	11.4	9.1	8.8	8.7	7.7	7.4	6.5	8.4
Pittsburg, Pa.	3.4	3.3	2.9	3.3	3.5	3.6	3.5	3.6	4.1	4.8	5.2	5.8	5.7	5.9	5.6	5.7	5.5	4.8	4.8	4.5	4.4	4.1	3.9	3.6	4.4
Pocatello, Idaho	10.5	10.6	11.5	12.3	11.2	11.1	11.1	12.0	11.9	11.5	12.3	12.1	11.1	11.1	11.4	10.7	10.9	11.1	9.9	8.5	7.3	8.2	9.0	9.5	10.7
Point Reyes Lt., Cal.	9.4	9.0	9.2	9.1	8.6	8.2	8.3	8.9	8.9	8.1	8.5	8.8	8.2	9.0	9.2	8.9	10.3	10.4	10.5	10.1	8.9	10.1	9.6	9.3	9.1
Port Crescent, Wash.	2.8	2.5	2.6	2.5	2.7	2.4	2.7	2.5	2.3	2.3	2.3	2.5	2.9	3.8	4.6	5.3	4.9	4.9	4.0	3.6	3.1	2.5	2.6	2.5	3.1
Port Huron, Mich.	8.8	9.2	8.7	8.8	8.8	8.5	8.1	8.2	8.3	8.9	9.8	9.9	11.3	10.8	11.0	11.3	10.8	10.4	10.2	10.4	10.1	9.9	9.6	9.6	9.6
Portland, Me.	4.7	4.8	4.8	4.9	5.2	5.4	5.3	5.8	6.8	6.8	6.9	7.1	7.4	7.8	8.0	7.7	7.4	6.6	5.8	5.8	5.6	5.4	5.7	5.4	6.1
Portland, Oreg.	6.5	6.0	6.0	6.3	6.7	6.8	6.3	6.4	5.9	6.0	6.9	7.2	7.5	7.6	7.8	8.8	8.2	8.3	8.0	8.2	8.1	8.4	7.8	6.9	7.2
Pueblo, Colo.	5.2	5.1	5.0	4.5	5.5	5.1	5.3	4.8	5.2	4.5	5.2	7.2	9.5	9.7	10.5	10.8	11.1	10.2	10.0	8.5	7.4	7.0	6.8	6.6	7.1
Raleigh, N. C.	5.7	5.4	5.6	5.6	5.6	5.4	5.8	5.8	6.2	7.1	7.3	7.5	7.5	7.6	7.2	7.2	6.9	5.9	5.3	5.2	5.5	5.7	6.1	6.1	6.2
Rapid City, S. Dak.	6.6	6.5	5.9	6.2	6.1	6.8	7.0	7.2	7.3	7.1	6.7	6.8	8.4	9.4	9.8	10.7	10.6	9.8	8.2	6.8	6.5	7.0	6.5	6.1	7.5
Red Bluff, Cal.	5.4	6.2	6.7	7.1	6.8	6.6	6.7	6.9	6.9	6.6	7.0	8.3	9.7	10.1	9 9	9.1	9 3	8.6	8.4	7.8	6.7	6.1	5.4	5.5	7.4
Richmond, Va.	4.5	4.5	4.5	5.1	5.3	5.2	5.2	5.2	6.1	6.4	6.6	6.8	7.0	7.3	7.0	6.8	6.3	5.4	4.9	4.9	4.7	4.9	4.9	4.8	5.6
Rochester, N. Y.	4.5	4.6	5.0	5.1	5.4	5.5	5.9	6.4	6.3	6.7	6.6	6.8	7.4	7.4	7.3	6.7	6.1	5.3	5.1	4.9	4.8	4.6	4.3	4.4	5.7
Roseburg, Oreg.	1.8	1.7	1.6	2.2	1.8	2.6	2.1	2.0	2.4	2.1	2.2	2.5	2.6	2.7	3.2	3.4	3.8	4.6	4.4	4.7	3.0	2.5	2.1	2.3	2.7
Sacramento, Cal.	7.3	7.5	8.0	8.0	8.4	8.4	8.0	8.0	8.3	8.5	8.3	7.7	8.5	8.8	9.2	8.8	8.8	8.2	8.2	7.2	7.2	7.3	7.5	7.6	8.1
St. Louis, Mo.	7.9	8.2	8.0	7.4	7.5	7.7	7.6	7.6	7.6	7.8	8.2	9.5	10.0	10.1	10.3	10.7	10.6	9.9	8.8	9.1	8.8	8.0	8.0	7.9	8.6
St. Paul, Minn.	6.5	6.0	5.8	5.6	6.1	5.9	5.5	5.9	5.9	7.1	7.7	8.7	9.2	9.4	9.5	9.8	9.7	8.5	8.0	7.7	7.4	6.8	6.9	6.5	7.3
Salt Lake City, Utah	4.3	3.8	3.8	3.7	3.8	4.3	4.2	4.6	4.5	3.7	4.3	6.2	7.6	8.4	10.1	10.6	9.5	8.4	7.4	5.7	5.1	5.1	4.2	4.3	5.7
San Antonio, Tex.	7.4	7.0	6.6	6.3	6.3	6.2	6.1	6.2	6.1	7.2	8.9	9.2	9.8	10.4	10.3	10.6	10.5	10.2	10.8	9.5	9.2	9.6	9.0	8.1	8.4
San Diego, Cal.	3.3	3.7	3.5	4.0	3.6	3.6	3.7	3.8	3.9	3.9	3.5	4.4	5.6	7.5	9.5	10.2	10.7	10.5	9.7	8.9	7.1	5.0	4.2	3.9	5.7
Sandusky, Ohio	6.1	5.5	5.3	5.9	5.9	6.2	6.2	6.0	6.6	7.0	7.0	6.8	7.5	8.1	7.8	7.5	7.3	6.9	6.8	7.0	6.6	7.0	6.5	6.3	6.7
Sandy Hook, N. J.	14.5	14.3	14.4	14.1	14.5	14.7	14.5	15.4	16.0	16.1	15.4	14.7	14.8	15.1	14.8	15.7	16.0	16.8	16.6	16.3	15.4	14.7	14.0	14.7	15.1
San Francisco, Cal.	7.5	8.1	7.5	7.0	6.0	5.5	5.1	5.1	5.3	5.5	5.7	6.3	7.2	7.7	8.8	10.3	12.5	13.2	13.7	14.2	12.1	11.1	9.7	8.2	8.5
San Luis Obispo, Cal.	2.4	2.4	2.8	2.7	2.9	3.0	2.6	2.8	2.8	2.1	2.4	3.2	4.9	5.5	6.5	7.7	8.3	8.3	7.3	6.8	5.2	3.7	3.3	2.5	4.2
Santa Fe, N. Mex.	6.6	5.9	5.0	4.9	5.2	4.8	4.7	4.3	4.5	5.6	6.6	8.1	8.8	9.1	9.7	9.8	9.2	9.4	8.5	6.8	5.8	6.8	7.5	7.8	6.9
Sault Ste. Marie, Mich	6.5	6.7	6.8	6.3	7.0	6.9	7.0	7.0	7.1	8.4	9.0	9.7	9.9	10.2	10.5	10.5	10.0	9.3	8.4	7.4	7.2	6.7	7.0	6.6	8.0
Savannah, Ga.	6.6	7.4	7.5	7.4	7.3	7.2	7.9	8.7	9.6	10.4	10.4	11.1	11.6	11.6	11.9	11.7	10.9	9.0	7.9	7.2	7.2	7.0	7.1	7.0	8.8
Seattle, Wash.	5.9	6 2	5.7	5.6	5.9	5.2	5.2	4.5	4.9	5.1	4.7	4.9	5.4	5.3	5.6	5.8	5.8	5.9	5.4	5.1	5.3	5.4	5.5	5.4	5.4
Shreveport, La.	6.1	6.1	5.4	5.2	4.7	4.5	4.7	4.8	5.2	6.7	7.2	7.3	7.7	8.5	8.6	8.5	8.7	8.0	6.5	5.9	6.0	6.3	6.3	5.6	6.4
Sioux City, Iowa.	11.7	10.9	11.1	11.4	11.2	10.9	10.0	9.9	10.3	11.4	11.8	12.9	14.3	14.8	14.8	15.6	15.8	14.6	12.8	12.9	12.9	13.1	12.5	11.7	12.5
Spokane, Wash.	5.2	5.3	4.9	5.2	5.2	4.9	4.6	4.8	4.7	4.6	5.0	5.3	5.6	6.3	6.5	7.0	7.1	7.1	6.7	6.9	5.8	5.1	5.0	4.5	5.5
Springfield, Ill.	8.2	7.8	7.5	7.6	7.4	7.5	7.7	7.5	8.2	9.0	10.1	10.8	11.1	10.7	10.5	10.0	10.3	8.9	8.1	8.1	8.4	8.3	8.9	8.5	8.8
Springfield, Mo.	10.8	10.9	10.4	10.7	10.3	10.1	10.0	9.5	9.2	10.2	11.2	12.0	12.3	12.4	11.6	12.0	11.7	11.3	9.6	9.5	10.4	10.4	10.6	10.7	10.7
Tacoma, Wash.																									
Tampa, Fla.	5.6	5.8	5.6	5.5	5.2	5.2	5.0	6.0	7.9	9.4	10.5	10.9	11.1	11.6	11.2	10.7	10.7	8.8	7.3	6.8	6.7	6.2	5.6	5.8	7.7
Toledo, Ohio	6.9	7.1	7.0	7.3	7.0	7.2	7.1	7.1	7.6	8.2	8.5	9.5	9.6	10.5	11.0	10.8	10.0	8.8	7.8	7.8	7.7	7.7	7.2	7.2	8.2
Vicksburg, Miss.	6.2	6.2	5.8	5.7	6.0	6.2	6.6	6.8	7.1	7.1	6.8	6.7	7.7	7.5	7.5	7.2	7.1	6.1	4.4	4.9	5.9	6.5	6.8	6.4	6.5
Vineyard Haven, Mass.	7.5	7.3	7.3	7.6	7.5	7.3	7.4	8.1	9.3	9.6	9.9	9.9	10.2	9.7	9.7	9.2	8 6	8.3	8.0	7.9	8.1	7.6	7.4	8.1	8.4
Walla Walla, Wash.	4.9	5.0	4.8	4.8	4.9	4.6	4.2	4.6	4.4	4.4	4.5	4.9	5.6	5.9	5.6	5.2	5.3	4.9	4.6	4.1	4.1	4.0	4.2	4.3	4.7
Washington, D. C.	3.4	3.6	3.7	4.2	4.2	3.9	4.2	4.7	5.6	6.5	6.9	7.6	8.0	8.0	8.3	7.5	6.1	4.5	3.8	3.9	3.9	3.7	3.8	3.6	5.2
Wichita, Kans.																									
Williston, N. Dak.	7.7	7.1	7.5	6.9	6.4	6.2	6.4	6.4	6.1	6.7	8.0	8.8	9.6	10.0	11.9	13.0	12.6	11.5	9.9	8.6	7.3	7.5	7.7	7.5	8.4
Wilmington, N. C.	7.1	6.9	7.5	7.6	8.2	8.0	8.1	8.5	8.9	9.7	10.7	10.3	10.2	10.5	10.9	10.3	10.0	7.7	6.8	7.2	7.7	7.8	7.9	7.5	8.6
Winnemucca, Nev.	8.2	8 1	8.0	8.4	8.4	7.6	7.8	8.8	8.5	8.6	9.3	10.0	10.7	11.3	11.7	11.2	10.9	10.4	9.7	9.2	7.8	7.2	7.2	8.0	9.0
Woods Hole, Mass.	12.5	12.5	12.9	13.0	12.9	12.5	12.7	12.6	13.1	12.6	13.1	13.5	14.3	14.1	14.0	13.1	12.7	12.8	12.6	12.6	13.1	12.5	12.7	13.1	13.0
Yankton, S. Dak.	6.5	7.0	6.8	5.7	5.4	5.7	5.7	5.7	6.0	7.1	7.8	9.4	10.4	10.8	11.5	11.0	10.6	9.7	8.1	7.1	6.9	7.0	6.9	6.6	7.7
West Indies.																									
Basseterre, St. Kitts.	5.9	5.9	5.9	5.7	6.0	5.8	6.7	8.0	8.8	9.2	9.2	9.0	8.5	8.9	8.1	7.4	7.0	6.5	6.5	6.3	6.6	6.2	6.6	6.3	7.1
Bridgetown, Bar.	4.2	4.1	4.1	4.1	4.1	4.0	5.1	7.5	9.0	10.0	10.7	10.5	10.0	9.9	9.0	8.1	6.0	4.6	4.4	4.6	4.9	4.5	4.1	4.4	6.3
Cienfuegos, Cuba	5.6	5.8	5.8	5.3	5.6	5.4	5.5	6.3	7.5	8.3	9.4	9.6	9.8	10.3	10.6	10.6	9.9	8.3	7.5	7.2	6.5	5.5	5.5	5.6	7.4
Havana, Cuba	12.2	11.4	10.5	10.1	10.7	10.5	10.8	12.0	13.5	15.6	17.7	18.9	19.1	19.6	18.7	18.3	17.4	16.5	16.1	15.7	15.0	14.2	13.4	12.1	14.6
Kingston, Jamaica.																									
Port of Spain, Trin.	1.3	1.4	1.3	1.4	1.1	0.9	2.0	4.5	6.0	6.3	6.4	6.0	7.0	5.9	5.5	5.0	4.9	3.6	3.5	3.0	2.2	2.3	1.7	1.6	3.5
Puerto Principe, Cuba	4.9	4.5	3.9	4.4	4.4	4.3	4.2	5.8	8.4	10.3	10.6	10.9	11.1	12.0	11.5	10.6	10.1	8.7	6.8	6.8	5.7	6.2	6.2	5.6	7.4
San Juan, Porto Rico.	5.1	5.5	4.9	5.1	4.8	4.7	5.3	6.0	8.3	10.2	11.9	12.2	13.0	12.4	11.6	10.2	8.8	8.2	8.1	6.9	6.6	6.3	6.0	4.9	7.8
Santiago de Cuba.	3.8	3.8	3.6	3.7	3.5	3.8	3.7	4.8	5.3	6.1	6.1	6.3	6.7	6.9	7.1	6.1	5.2	4.2	4.0	4.5	4.2	4.3	4.6	4.0	4.9
Santo Domingo, S. D.	3.3	3.5	3.6	3.2	3.3	3.6	3.7	3.9	3.9	4.4	5.2	5.8	5.9	6.0	5.7	5.3	5.2	4.9	4.4	4.2	4.1	4.3	4.1	4.2	4.4
Willemstad, Curaçao.	5.6	5.6	5.2	5.2	5.4	5.6	6.3	7.9	9.3	10.3	10.5	10.7	10.6	10.1	10.1	10.4	10.9	9.9	8.9	8.5	7.5	7.0	6.6	6.0	8.1

TABLE VI.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of October, 1899.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	26	14	13	25	n. 45 w.	17
Portland, Me	25	14	8	29	n. 62 w.	24
Northfield, Vt	22	35	3	5	s. 9 w.	13
Boston, Mass	25	13	9	27	n. 56 w.	22
Nantucket, Mass	20	14	17	21	n. 34 w.	7
Woods Hole, Mass	21	15	16	24	n. 53 w.	10
Block Island, R. I	19	14	19	23	n. 39 w.	6
New Haven, Conn	27	15	18	14	n. 18 e.	13
Middle Atlantic States.						
Albany, N. Y	23	27	7	15	s. 63 w.	9
Binghamton, N. Y.†	10	7	4	18	n. 78 w.	14
New York, N. Y	23	17	17	24	n. 49 w.	9
Harrisburg, Pa.†	15	6	8	9	n. 6 w.	9
Philadelphia, Pa	25	18	17	17	n.	7
Atlantic City, N. J	21	16	18	15	n. 31 e.	6
Cape May, N. J	23	18	21	16	n. 45 e.	7
Baltimore, Md	23	14	29	12	n. 62 e.	19
Washington, D. C	27	17	18	12	n. 31 e.	12
Lynchburg, Va	13	19	24	11	s. 65 e.	14
Norfolk, Va	28	11	32	4	n. 59 e.	33
Richmond, Va	33	17	17	6	n. 34 e.	19
South Atlantic States.						
Charlotte, N. C	27	13	33	10	n. 59 e.	27
Hatteras, N. C	36	12	14	7	n. 16 e.	25
Kittyhawk, N. C	30	13	36	7	n. 60 e.	34
Raleigh, N. C	41	10	17	8	n. 16 e.	32
Wilmington, N. C	36	7	30	6	n. 40 e.	38
Charleston, S. C	37	3	29	9	n. 30 e.	39
Augusta, Ga	29	8	27	9	n. 41 e.	28
Savannah, Ga	32	5	28	7	n. 38 e.	34
Jacksonville, Fla	32	5	34	9	n. 43 e.	37
Florida Peninsula.						
Jupiter, Fla	25	5	34	15	n. 44 e.	28
Key West, Fla	37	3	30	10	n. 30 e.	39
Tampa, Fla	42	4	20	11	n. 2 e.	38
Eastern Gulf States.						
Atlanta, Ga	16	13	37	9	n. 84 e.	28
Macon, Ga †	20	3	16	6	n. 30 e.	20
Pensacola, Fla.†	15	3	16	2	n. 49 e.	18
Mobile, Ala	32	17	17	7	n. 34 e.	18
Montgomery, Ala	26	5	33	6	n. 52 e.	34
Meridian, Miss.†	11	6	17	4	n. 69 e.	14
Vicksburg, Miss	18	18	28	9	e.	19
New Orleans, La	22	20	28	9	n. 84 e.	19
Western Gulf States.						
Shreveport, La	15	25	30	10	s. 63 e.	22
Fort Smith, Ark	10	17	40	9	s. 77 e.	32
Little Rock, Ark	19	21	28	11	s. 83 e.	17
Corpus Christi, Tex	16	21	38	7	s. 81 e.	31
Fort Worth, Tex†	7	15	9	10	s. 7 w.	8
Galveston, Tex	17	23	35	4	s. 79 e.	32
Palestine, Tex	28	22	18	3	n. 68 e.	16
San Antonio, Tex	22	22	32	2	e.	30
Ohio Valley and Tennessee.						
Chattanooga, Tenn	26	20	21	10	n. 61 e.	12
Knoxville, Tenn	30	12	25	12	n. 36 e.	22
Memphis, Tenn	21	23	28	7	s. 85 e.	21
Nashville, Tenn	20	23	22	10	s. 76 e.	12
Lexington, Ky.†	6	17	15	1	s. 52 e.	18
Louisville, Ky	20	26	26	4	s. 75 e.	23
Evansville, Ind.†	11	11	16	1	e.	15
Indianapolis, Ind	20	31	14	3	s. 45 e.	16
Cincinnati, Ohio	17	24	31	6	s. 74 e.	26
Columbus, Ohio	17	24	29	5	s. 74 e.	25
Pittsburg, Pa	24	21	17	18	n. 18 w.	3
Parkersburg, W. Va	23	23	19	7	e.	12
Elkins, W. Va	22	16	12	10	n. 18 e.	6
Lower Lake Region.						
Buffalo, N. Y	12	21	24	17	s. 38 e.	11
Oswego, N. Y	16	30	28	6	s. 58 e.	26
Rochester, N. Y	15	24	18	22	s. 24 w.	10
Erie, Pa	13	27	18	15	s. 12 e.	14
Cleveland, Ohio	14	29	28	7	s. 55 e.	26
Sandusky, Ohio	12	30	20	12	s. 24 e.	20
Toledo, Ohio	20	28	17	8	s. 48 e.	12
Detroit, Mich	22	24	17	11	s. 72 e.	6
Upper Lake Region.						
Alpena, Mich	21	22	15	23	s. 83 w.	8
Escanaba, Mich	23	25	13	13	s.	2
Grand Haven, Mich	18	23	24	10	s. 70 e.	15
Marquette, Mich	13	27	20	19	s. 4 e.	14
Port Huron, Mich	15	30	17	10	s. 25 e.	17
Sault Ste. Marie, Mich	11	20	27	18	s. 51 w.	14
Chicago, Ill	15	29	21	10	s. 38 e.	18
Milwaukee, Wis	15	29	14	19	s. 20 w.	15
Green Bay, Wis	15	30	14	12	s. 8 e.	15
Duluth, Minn	27	15	17	21	n. 18 w.	13
North Dakota.						
Moorhead, Minn	19	21	20	22	s. 45 w.	3
Bismarck, N. Dak	27	11	20	24	n. 14 w.	16
Williston, N. Dak	27	14	11	21	n. 38 w.	16
Upper Mississippi Valley.						
St. Paul, Minn	20	23	21	15	s. 63 e.	7
La Crosse, Wis. †	9	15	9	5	s. 34 e.	7
Davenport, Iowa	14	25	26	13	s. 50 e.	17
Des Moines, Iowa	21	24	22	11	s. 75 e.	11
Dubuque, Iowa	17	30	15	13	s. 9 e.	13
Keokuk, Iowa	20	26	21	10	s. 61 e.	12
Cairo, Ill	21	26	21	8	s. 69 e.	14
Springfield, Ill	18	33	15	6	s. 31 e.	18
Hannibal, Mo.†	9	13	8	6	s. 27 e.	4
St. Louis, Mo	20	30	16	3	s. 52 e.	16
Missouri Valley.						
Columbia, Mo.*	9	13	13	4	s. 70 e.	12
Kansas City, Mo	18	27	25	10	s. 59 e.	18
Springfield, Mo	13	31	24	3	s. 49 e.	28
Lincoln, Nebr	20	31	17	4	s. 50 e.	17
Omaha, Nebr	22	23	21	7	s. 86 e.	14
Sioux City, Iowa†	9	14	7	15	s. 22 e.	5
Pierre, S. Dak	22	19	17	9	n. 34 w.	4
Huron, S. Dak	22	14	18	23	n. 32 w.	9
Yankton, S. Dak †	7	3	10	14	n. 45 w.	6
Northern Slope.						
Havre, Mont	14	18	9	36	s. 82 w.	27
Miles City, Mont	21	16	10	24	n. 70 w.	15
Helena, Mont	8	26	3	42	s. 65 w.	43
Kalispell, Mont	22	17	9	28	n. 75 w.	10
Rapid City, S. Dak	19	14	17	28	n. 66 w.	12
Cheyenne, Wyo	19	13	8	32	n. 76 w.	25
Lander, Wyo	12	29	16	25	s. 28 w.	19
North Platte, Nebr	21	13	17	26	n. 45 w.	12
Middle Slope.						
Denver, Colo	24	24	20	9	e.	11
Pueblo, Colo	18	15	23	18	n. 59 e.	6
Concordia, Kans	15	36	11	7	s. 11 e.	21
Dodge, Kans	24	23	17	10	n. 82 e.	7
Wichita, Kans	18	24	14	4	s. 59 e.	12
Oklahoma, Okla	16	36	12	8	s. 3 e.	20
Southern Slope.						
Abilene, Tex	12	32	29	10	s. 44 e.	28
Amarillo, Tex	18	32	7	16	s. 33 w.	17
Southern Plateau.						
El Paso, Tex	19	15	18	28	n. 68 w.	11
Santa Fe, N. Mex	13	32	22	15	s. 30 e.	20
Flagstaff, Ariz	16	18	14	29	s. 82 w.	15
Phenix, Ariz	8	15	31	19	s. 60 e.	14
Yuma, Ariz	23	12	14	29	n. 54 w.	19
Independence, Cal	23	18	7	28	n. 77 w.	22
Middle Plateau.						
Carson City, Nev	18	21	13	26	s. 77 w.	13
Winnemucca, Nev	24	20	19	20	n. 14 w.	1
Cedar City, Utah	11	34	16	14	s. 5 e.	23
Salt Lake City, Utah	20	23	24	13	s. 74 e.	11
Grand Junction, Colo	27	12	21	18	n. 11 e.	15
Northern Plateau.						
Baker City, Oreg	18	33	12	13	s. 4 w.	15
Boise, Idaho	9	14	21	29	s. 54 w.	9
Pocatello, Idaho	11	26	10	23	s. 41 w.	20
Spokane, Wash	16	26	19	16	s. 17 e.	10
Walla Walla, Wash	5	29	15	14	s. 4 e.	14
North Pacific Coast Region.						
Fort Canby, Wash	13	22	32	11	s. 67 e.	23
Neah, Wash	2	13	35	16	s. 60 e.	22
Port Crescent, Wash.*	1	8	13	14	s. 8 w.	7
Seattle, Wash	14	30	26	9	s. 47 e.	23
Portland, Oreg	20	26	19	20	s. 9 w.	6
Roseburg, Oreg	23	11	24	16	n. 34 e.	14
Middle Pacific Coast Region.						
Eureka, Cal	20	20	17	20	w.	3
Mount Tamalpais, Cal	31	7	12	30	n. 18 w.	25
Red Bluff, Cal	29	20	11	17	n. 34 w.	11
Sacramento, Cal	24	24	14	19	w.	5
San Francisco, Cal	6	20	6	38	s. 66 w.	35
South Pacific Coast Region.						
Fresno, Cal	16	12	16	30	n. 74 w.	15
Los Angeles, Cal	17	16	6	38	n. 88 w.	32
San Diego, Cal	30	12	9	27	n. 45 w.	26
San Luis Obispo, Cal	30	15	4	16	n. 39 w.	19
West Indies.						
Basseterre, St. Kitts Island	20	10	43	3	n. 76 e.	41
Bridgetown, Barbados	8	18	51	0	s. 80 e	51
Cienfuegos, Cuba	50	6	29	5	n. 29 e.	50
Havana, Cuba	26	6	40	8	n. 58 e.	38
Port of Spain, Trinidad	9	8	46	4	n. 89 e.	42
Puerto Principe, Cuba	23	11	37	6	n. 66 e.	34
Roseau, Dominica, W. I.	21	10	31	16	n. 54 e.	20
San Juan, Porto Rico	3	36	31	8	s. 35 e.	40
Santiago de Cuba, Cuba	29	13	34	3	n. 63 e.	35
Santo Domingo, S. Domingo, W. I.	42	13	6	6	n. 15 e.	42
Willemstad, Curaçao	5	17	41	0	s. 74 e.	43

* From observations at 8 p. m. only.

† From observations at 8 a. m. only.

TABLE VII.—*Thunderstorms and auroras, October, 1899.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	53	T.	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	1	2	6	1	....	....	....	....	....	....	....	1	....	....	....	13	7	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arizona	53	T.	1	2	7	3	3	3	..	....	....	....	6	....	....	1	....	..	....	....	....	....	....	....	....	....	....	..	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	26	8	A.
Arkansas	57	T.	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	1	....	3	1	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7	5	A.
California	189	T.	1	....	....	....	....	4	1	....	....	1	7	7	2	....	....	....	....	2	1	2	3	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	31	11	A.
Colorado	73	T.	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	2	6	5	A.
Connecticut	22	T.	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Delaware	5	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Dist. of Columbia	4	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Florida	45	T.	....	....	1	3	4	....	....	....	....	1	....	....	....	....	1	....	....	....	....	2	6	1	1	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20	9	A.
Georgia	54	T.	....	....	....	....	1	....	5	....	....	....	....	....	....	....	....	....	....	2	8	1	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	17	5	A.
Idaho	27	T.	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	3	A.
Illinois	92	T.	1	....	....	....	....	....	....	....	....	....	....	....	9	5	....	1	....	....	17	....	1	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	34	6	A.
Indiana	55	T.	....	....	....	....	....	....	....	....	....	1	....	....	5	....	....	1	1	....	8	....	....	....	....	....	....	....	....	....	....	....	....	2	2	A.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	14	3	T.
Indian Territory	8	T.	....	..	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	2	A.
Iowa	126	T.	....	2	....	....	2	....	....	....	....	2	5	....	6	14	4	1	....	....	....	....	4	....	2	11	2	....	..	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60	11	A.
Kansas	74	T.	....	2	1	....	....	....	....	....	1	1	....	....	....	5	6	2	....	....	....	....	....	....	....	5	6	....	....	....	....	....	....	2	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	29	9	A.
Kentucky	45	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	6	1	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8	3	A.
Louisiana	45	T.	....	....	....	....	....	....	....	....	....	1	4	4	....	....	1	1	....	2	3	2	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18	8	A.
Maine	17	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maryland	39	T.	....	....	....	1	1	....	....	....	1	....	1	....	....	....	....	....	....	1	....	....	....	1	1	....	....	....	....	1	....	....	....	3	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	6	A.
Massachusetts	54	T.	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Michigan	107	T.	....	....	....	....	1	....	....	....	1	....	....	....	12	4	14	2	....	....	1	2	4	18	5	3	....	....	....	2	....	....	....	0	0	T.
		A.	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	68	12	A.
Minnesota	64	T.	....	....	....	....	....	....	....	....	....	....	6	8	1	6	20	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
		A.	....	....	1	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	4	16	3	1	....	....	....	....	....	71	11	A.
Mississippi	42	T.	....	....	....	....	....	1	....	....	....	....	2	....	....	....	....	....	....	....	1	1	....	....	1	....	....	....	....	....	....	....	....	....	4	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	6	5	A.
Missouri	89	T.	....	....	....	....	....	....	....	....	....	3	....	....	1	5	....	3	....	....	4	....	....	....	....	....	....	1	....	....	....	....	....	17	6	T.
		A.	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	8	....	....	1	....	....	....	....	....	10	3	A.
Montana	37	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18	3	A.
Nebraska	145	T.	....	6	....	....	4	2	....	....	....	....	....	....	....	7	17	2	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	16	5	....	....	....	....	....	....	4	0	A.
Nevada	45	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	55	7	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Hampshire	20	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Jersey	50	T.	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
New Mexico	38	T.	1	1	1	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New York	103	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	6	6	T.
		A.	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	8	....	....	1	....	....	....	....	....	10	3	A.
North Carolina	56	T.	....	....	....	....	....	3	7	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13	3	A.
North Dakota	40	T.	....	....	....	....	....	....	....	....	....	....	2	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	2	A.
Ohio	124	T.	....	....	....	....	....	....	....	....	....	....	....	....	3	..	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	5	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	2	A.
Oklahoma	22	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	2	1	....	....	....	....	....	9	4	A.
Oregon	71	T.	....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	4	1	1	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8	5	A.
Pennsylvania	100	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Rhode Island	8	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	2	A.
South Carolina	44	T.	....	....	....	....	3	1	6	....	....	....	....	....	....	....	....	....	1	2	1	2	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	16	7	A.
South Dakota	52	T.	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	2	....	....	....	....	....	....	....	6	7	....	....	....	....	....	....	....	....	3	3	....	....	....	....	....	....	....	21	5	A.
Tennessee	61	T.	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	....	12	3	....	....	....	....	....	....	....	....	....	....	....	....	2	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	18	5	A.
Texas	83	T.	....	....	....	....	....	1	....	1	....	2	....	....	....	....	3	6	1	4	3	1	....	....	....	....	....	2	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	24	10	A.
Utah	34	T.	....	....	....	....	....	....	....	....	....	....	4	2	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	6	1	16	7	A.
Vermont	14	T.	..	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Virginia	47	T.	....	....	....	....	....	....	2	....	..	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	A.
Washington	55	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	2	....	1	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	3	A.
West Virginia	38	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wisconsin	60	T.	1	....	....	....	....	....	....	....	1	....	5	14	6	7	....	....	....	....	....	....	7	3	10	2	....	....	....	....	....	....	....	56	10	T.
		A.	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2	2	A.
Wyoming	18	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Sums	2,804	T.	5	15	11	9	12	12	25	2	4	19	40	29	47	69	80	24	11	11	87	21	20	32	29	65	23	8	4	5	1	7	5	732	....	T.
		A.	1	0	1	0	18	3	0	0	0	0	0	0	0	0	1	1	1	0	0	0	3	3	0	1	0	0	0	0	1	0	0	33	....	A.

TABLE VIII.—*Average hourly sunshine (in percentages), October, 1899.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour. A.M. 5	6	7	8	9	10	11	Noon	P.M. 1	2	3	4	5	6	7	8	Hours of sunshine. Total. Actual.	Possible.	Percent of possible.	Personal estimate.
																		Hours.	*Hours.*		
Albany, N. Y.	T.	.....	75	28	24	31	39	60	69	75	70	61	52	33	36	.....	.....	169.2	341.8	50	33
Atlanta, Ga.	T.	.....	33	40	40	45	55	62	66	68	59	58	53	49	37	.....	.....	188.1	350.9	54	55
Atlantic City, N. J.	P.	.....	100	48	47	55	66	69	58	56	65	66	59	52	40	.....	.....	200.2	346.0	58	52
Baltimore, Md.	T.	.....	100	36	41	50	67	74	78	79	79	73	60	42	47	.....	.....	216.9	346.0	62	49
Binghamton, N. Y.	T.	.....	0	19	27	46	68	80	82	84	80	73	50	47	54	.....	.....	206.6	342.5	60	42
Bismarck, N. Dak.	P.	.....	0	27	35	47	48	48	50	50	51	49	46	46	43	.....	.....	133.9	336.7	46	45
Boise, Idaho	P.	.....	100	41	42	50	54	56	57	55	52	48	49	45	42	.....	.....	170.1	340.5	50	43
Boston, Mass.	T.	.....	60	21	29	34	46	58	55	55	52	49	44	33	47	.....	.....	150.5	342.5	44	37
Buffalo, N. Y.	T.	.....	25	35	44	56	59	68	75	76	73	63	50	37	35	.....	.....	197.4	341.8	58	37
Cedar City, Utah.	T.	.....	100	72	78	82	90	96	97	97	91	95	80	69	50	.....	.....	295.3	347.3	85	60
Charleston, S. C.	T.	.....	0	23	24	39	55	60	68	74	64	59	44	25	22	.....	.....	167.8	351.5	48	47
Chattanooga, Tenn.	T.	.....	67	35	39	52	63	69	74	75	67	59	51	50	48	.....	.....	201.5	350.1	58	55
Cheyenne, Wyo.	P.	.....	0	26	44	52	49	53	58	55	63	61	56	45	31	.....	.....	175.7	343.9	51	39
Chicago, Ill.	T.	.....	0	22	34	49	58	68	67	62	59	55	48	43	28	.....	.....	176.1	342.5	51	47
Cincinnati, Ohio	T.	.....	64	57	55	55	57	63	69	69	71	65	61	59	68	.....	.....	214.8	346.0	62	60
Cleveland, Ohio	T.	.....	0	31	32	40	47	54	63	65	55	54	44	38	43	.....	.....	163.8	342.5	48	54
Columbia, Mo.	T.	.....	60	76	75	75	79	84	89	87	85	86	82	75	78	.....	.....	281.3	346.0	81	69
Columbus, Ohio	T.	.....	45	42	39	42	53	63	70	67	64	62	60	61	65	.....	.....	196.5	344.9	57	52
Denver, Colo.	P.	.....	45	49	58	62	69	75	74	75	80	77	65	55	41	.....	.....	230.1	344.9	67	56
Des Moines, Iowa	T.	.....	100	40	48	65	78	82	80	84	84	85	84	66	64	.....	.....	249.3	342.5	73	60
Detroit, Mich.	T.	.....	60	38	52	66	73	78	79	82	80	73	65	55	60	.....	.....	232.7	342.5	68	56
Dodge, Kans.	P.	.....	70	69	73	74	74	78	75	78	81	81	78	74	69	.....	.....	263.5	347.3	76	66
Dubuque, Iowa	T.	.....	0	42	42	55	72	72	71	72	68	65	65	53	60	.....	.....	211.6	342.5	62	53
Eastport, Me.	P.	.....	100	28	28	38	60	60	57	57	58	56	49	44	43	.....	.....	166.6	339.8	49	35
Elkins, W. Va.	T.	.....	0	10	14	41	60	74	70	69	68	55	38	22	32	.....	.....	165.0	346.0	48	44
Erie, Pa.	T.	.....	0	41	39	36	41	57	61	60	57	52	47	45	53	.....	.....	168.2	342.5	49	48
Escanaba, Mich.	T.	.....	0	15	18	17	30	41	43	40	32	29	19	14	19	.....	.....	91.9	338.5	27	27
Eureka, Cal.	P.	.....	55	31	33	41	43	47	58	60	67	59	57	51	51	.....	.....	172.6	343.9	50	45
Fresno, Cal.	T.	.....	100	40	49	64	69	77	75	81	77	75	65	47	34	.....	.....	225.9	347.9	65	59
Galveston, Tex.	P.	.....	0	29	67	86	82	80	81	84	84	88	82	60	14	.....	.....	256.7	355.9	72	54
Grand Junction, Colo.	P.	.....	0	46	55	55	60	63	63	62	69	78	73	65	64	.....	.....	217.5	346.0	63	51
Harrisburg, Pa.	T.	.....	100	36	31	33	49	57	64	67	59	49	45	39	61	.....	.....	167.9	344.9	49	41
Helena, Mont.	P.	.....	0	29	30	47	51	45	47	55	61	61	56	40	36	.....	.....	161.8	336.7	48	37
Huron, S. Dak.	T.	.....	100	51	52	52	57	62	68	69	65	53	43	44	33	.....	.....	188.5	340.5	55	50
Indianapolis, Ind.	T.	.....	55	55	55	60	66	70	66	70	64	57	55	49	53	.....	.....	208.4	344.9	60	52
Jacksonville, Fla.	T.	.....	0	14	26	45	59	63	61	54	55	43	29	32	24	.....	.....	152.1	354.7	43	34
Jupiter, Fla.	T.	.....	22	27	38	67	83	82	81	83	85	78	67	54	48	.....	.....	238.5	357.1	67	43
Kalispell, Mont.	T.	.....	.....	22	29	37	55	70	72	61	62	55	49	29	27	.....	.....	167.7	335.8	50	40
Kansas City, Mo.	P.	.....	100	66	69	73	73	75	71	69	76	75	73	77	78	.....	.....	252.1	346.0	73	71
Key West, Fla.	T.	.....	31	30	38	65	68	72	75	70	62	63	55	25	24	.....	.....	197.1	358.6	55	49
Knoxville, Tenn.	T.	.....	67	44	47	58	66	72	78	76	69	66	51	44	45	.....	.....	211.9	348.9	61	57
Lexington, Ky.	T.	.....	65	42	53	64	67	72	77	72	72	67	64	53	51	.....	.....	221.0	347.3	64	51
Little Rock, Ark.	T.	.....	67	55	60	68	80	86	88	90	93	86	82	70	63	.....	.....	272.0	350.1	78	62
Los Angeles, Cal.	P.	.....	33	41	55	64	68	68	83	85	88	87	85	78	74	.....	.....	257.6	350.9	73	62
Louisville, Ky.	T.	.....	70	50	50	65	66	71	72	72	75	70	66	59	63	.....	.....	226.0	347.3	65	55
Macon, Ga.	T.	.....	33	26	52	61	71	78	82	81	75	73	63	44	31	.....	.....	221.6	351.5	63	51
Meridian, Miss.	T.	.....	40	47	46	58	67	78	83	79	69	67	59	47	42	.....	.....	221.8	352.8	63	55
Minneapolis, Minn.	T.	.....	0	26	35	37	46	57	63	64	59	54	43	29	29	.....	.....	159.2	339.8	47	.....
Mount Tamalpais, Cal.	P.	.....	100	59	58	64	61	66	69	71	76	76	75	65	64	.....	.....	234.0	347.3	67	54
Nashville, Tenn.	T.	.....	50	34	37	55	62	71	71	70	65	63	59	46	39	.....	.....	200.0	348.9	57	61
New Haven, Conn.	T.	.....	64	30	26	38	55	50	61	59	66	67	48	38	45	.....	.....	169.3	343.9	49	52
New Orleans, La.	T.	.....	17	38	59	70	78	80	80	74	68	60	41	39	32	.....	.....	217.2	354.7	61	43
New York, N. Y.	T.	.....	64	33	34	41	53	63	68	71	73	66	56	44	48	.....	.....	189.3	343.9	55	52
Northfield, Vt.	P.	.....	0	23	24	25	37	45	47	47	53	54	47	37	35	.....	.....	137.2	340.5	40	29
Oklahoma, Okla.	T.	.....	67	70	81	80	86	88	87	88	92	88	80	65	62	.....	.....	285.8	350.1	82	68
Parkersburg, W. Va.	T.	.....	55	36	32	43	53	57	63	61	63	58	45	33	45	.....	.....	191.1	346.0	49	47
Phenix, Ariz.	P.	.....	33	69	71	80	82	83	80	79	81	82	80	77	66	.....	.....	274.5	351.5	78	69
Philadelphia, Pa.	T.	.....	100	34	37	54	68	73	77	80	78	69	58	52	63	.....	.....	215.0	344.9	62	50
Pittsburg, Pa.	T.	.....	100	44	39	32	40	45	54	53	60	58	50	42	69	.....	.....	164.2	343.9	48	54
Pocatello, Idaho	T.	.....	25	32	31	43	52	59	61	59	61	49	40	33	40	.....	.....	162.0	341.8	47	32
Portland, Me.	T.	.....	100	22	38	49	55	62	72	68	60	58	46	28	22	.....	.....	172.5	340.5	51	39
Portland, Oreg.	T.	.....	0	9	9	23	30	39	47	54	46	41	37	25	28	.....	.....	113.0	338.5	33	34
Pueblo, Colo.	T.	.....	70	34	50	66	76	85	85	87	86	80	75	61	47	.....	.....	247.8	347.3	71	56
Raleigh, N. C.	T.	.....	67	44	47	52	64	71	74	71	66	62	62	41	30	.....	.....	204.3	348.9	59	57
Rochester, N. Y.	T.	.....	0	35	33	43	53	56	64	69	66	51	40	33	42	.....	.....	169.5	341.8	50	45
St. Louis, Mo.	T.	.....	55	48	53	62	75	85	86	85	84	79	77	59	60	.....	.....	249.5	346.0	72	64
St. Paul, Minn.	P.	.....	0	25	46	48	46	45	58	52	56	59	54	41	30	.....	.....	163.4	339.8	48	42
Salt Lake City, Utah.	P.	.....	100	44	47	61	60	64	64	54	61	59	56	53	46	.....	.....	195.5	343.9	57	52
San Diego, Cal.	P.	.....	0	44	54	60	72	78	78	79	80	81	82	81	80	.....	.....	253.8	351.5	72	72
San Francisco, Cal.	T.	.....	100	64	62	72	77	84	86	88	89	85	82	71	76	.....	.....	272.5	347.3	78	70
Santa Fe, N. Mex.	P.	.....	67	77	79	82	84	83	84	79	81	79	79	79	60	.....	.....	278.4	348.9	80	70
Sault Ste. Marie, Mich.	T.	.....	0	10	13	26	35	32	38	44	42	39	31	23	27	.....	.....	104.0	338.5	31	32
Savannah, Ga.	T.	.....	20	51	50	54	63	64	62	59	57	55	45	34	34	.....	.....	187.7	352.8	53	43
Seattle, Wash.	T.	.....	.....	15	12	22	34	41	48	49	44	35	25	14	20	.....	.....	104.6	335.8	31	29
Spokane, Wash.	T.	.....	.....	22	16	21	30	35	41	49	42	35	25	16	27	.....	.....	100.7	335.8	30	25
Tampa, Fla.	T.	.....	33	52	57	68	71	72	70	70	69	69	62	41	31	.....	.....	222.2	356.3	62	44
Topeka, Kans.	T.	.....	100	67	69	77	76	79	80	83	84	76	75	63	59	.....	.....	260.2	346.0	75	67
Vicksburg, Miss.	T.	.....	20	41	42	54	72	80	81	84	80	75	70	55	49	.....	.....	253.2	352.8	66	61
Washington, D. C.	P.	.....	100	46	42	53	61	66	71	70	68	71	59	57	61	.....	.....	210.0	346.0	61	59
Wilmington, N. C.	T.	.....	33	25	32	55	70	67	65	64	65	64	56	27	17	.....	.....	184.4	350.9	53	52
Yankton, S. Dak.	T.	.....	0	39	53	64	68	71	70	77	81	68	51	29	31	.....	.....	207.1	341.8	61	50
Basseterre, St. Kitts.	T.	.....	57	69	92	92	96	96	94	95	97	94	91	81	35	.....	.....	318.0	364.5	87	39
Bridgetown, Barbados	T.	.....	16	51	59	58	73	80	75	70	68	52	34	27	18	.....	.....	205.8	367.3	56	32
Cienfuegos, Cuba.	T.	.....	42	36	35	43	51	54	58	60	45	39	30	7	4	.....	.....	142.9	360.9	40	40
Havana, Cuba.	T.	.....	47	26	26	43	50	67	60	57	56	52	29	8	11	.....	.....	149.5	360.1	42	43
Kingston, Jamaica, W. I.	T.	.....	7	3	12	44	47	57	55	54	49	23	9	0	0	.....	.....	109.9	363.7	30	29
Port of Spain, Trinidad, W. I.	T.	.....	60	59	71	88	83	87	80	71	66	58	48	34	29	.....	.....	241.1	368.7	65	43
Puerto Principe, Cuba.	T.	.....	57	45	49	58	62	64	65	67	48	37	29	26	19	.....	.....	176.0	361.7	49	33
Roseau, Dominica, W. I.	T.	.....	47	45	59	75	74	79	75	68	67	63	53	39	26	.....	.....	223.5	366.4	61	57
San Juan, Porto Rico	T.	.....	20	24	60	77	82	90	87	84	74	58	50	34	15	.....	.....	226.5	363.7	62	40
Santiago de Cuba, Cuba*	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31
Santo Domingo, Santo Domingo	T.	.....	60	52	52	51	54	57	53	53	56	47	31	15	22	.....	.....	167.9	363.7	46	46
Willemstad, Curaçao	T.	.....	14	13	35	52	69	73	85	93	88	83	81	54	39	.....	.....	238.5	367.7	64	48

*Incomplete.

TABLE IX.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during October, 1899, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total am't of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time as indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	31			0.37														0.13			
Atlanta, Ga.	4-5			1.70														0.24			
Atlantic City, N. J.	6			1.88														0.40			
Baltimore, Md.	31			1.71														0.68			
Binghamton, N. Y.	‡			1.07														0.16			
Bismarck, N. Dak.	11-12			0.41														*			
Boise, Idaho	18			1.06														0.20			
Boston, Mass.	8			0.55														0.35			
Buffalo, N. Y.	17-18			0.59														0.33			
Cairo, Ill.	16-17	11.07 p. m.	2.10 p. m.	1.95	11.33 p. m.	12.33 a. m.	0.03	0.04	0.16	0.38	0.46	0.56	0.62	0.71	0.80	0.85	0.89	0.97			
Charleston, S. C.	20			0.40													0.40				
Cincinnati, Ohio	28			0.89														0.31			
Cleveland, Ohio	17			0.70														0.23			
Columbia, Mo.	16			0.77														0.29			
Columbus, Ohio	28-29			1.14														0.19			
Denver, Colo.	9-10			0.32														0.06			
Des Moines, Iowa	24-25			0.34														*			
Detroit, Mich.	27-28			1.43														0.16			
Dodge, Kans.	24-25			3.33														†1.15			
Duluth, Minn.	11-12			1.00														0.35			
Eastport, Me.	6-7			1.19														0.25			
Elkins, W. Va.	‡			1.17														0.15			
Erie, Pa.	17-18			0.76														0.25			
Escanaba, Mich.	25			0.28														0.12			
Fort Worth, Tex.	26-27			1.30														0.23			
Fresno, Cal.	13			0.57														0.23			
Galveston, Tex.	27			0.47														0.33			
Grand Junction, Colo.	11-12			0.68														0.33			
Hannibal, Mo.	26-27			0.92														0.12			
Harrisburg, Pa.	29			0.23														0.10			
Hatteras, N. C.	7	2.40 p. m.	11.55 p. m.	1.77	6.15 p. m.	7.15 p. m.	0.34	0.05	0.10	0.15	0.25	0.40	0.48	0.54	0.61	0.68	0.73	0.84			
Do	17	11.45 a. m.	7.30 p. m.	1.35	11.45 a. m.	12.20 p. m.	0.00	0.10	0.40	0.65	0.70	0.75	0.80	0.85							
Huron, S. Dak.	14-15			0.90														*			
Indianapolis, Ind.	27-28			1.32														0.23			
Jacksonville, Fla.	5	1.29 p. m.	2.35 p. m.	0.67	1.55 p. m.	2.10 p. m.	0.01	0.20	0.48	0.63	0.65										
Jupiter, Fla.	2-4	11.09 a. m.	11.58 a. m.	10.60	§	§	0.31	0.11	0.33	0.47	0.60	0.75	0.86	0.98	1.04	1.12	1.27	1.43	1.51	1.61	1.72
Do					‖	‖	2.63	0.14	0.32	0.43	0.51	0.59	0.69	0.75	0.86	0.94	1.00	1.25	1.85	1.95	1.98
Kalispell, Mont.	19-20			0.14														0.07			
Kansas City, Mo.	25			0.63														0.25			
Key West, Fla.	3	10.05 a. m.	5.45 p. m.	2.04	12.38 p. m.	12.55 p. m.	1.08	0.15	0.45	0.62	0.65	0.67	0.69	0.76							
Knoxville, Tenn.	28-29			0.85														0.40			
Lexington, Ky.	17			0.70														0.37			
Lincoln, Nebr.	24-25			2.27														0.53			
Little Rock, Ark.	16-17			0.58														0.23			
Los Angeles, Cal.	13			1.09														0.38			
Louisville, Ky.	17			1.00														0.51			
Macon, Ga.	19	8.07 p. m.	11.37 p. m.	1.28	8.17 p. m.	9.15 p. m.	0.02	0.11	0.27	0.37	0.45	0.50	0.59	0.64	0.68	0.72	0.75	0.85			
Memphis, Tenn.	16-17			0.98														0.47			
Meridian, Miss.	28			0.39														0.11			
Milwaukee, Wis.	11			0.16														0.11			
Montgomery, Ala.	28-29	4.05 p. m.	2.22 a. m.	1.64	9.40 p. m.	10.40 p. m.	0.27	0.05	0.11	0.21	0.32	0.44	0.53	0.59	0.64	0.72	0.81	0.90	1.02		
Nantucket, Mass.	6	9.15 a. m.	8.45 p. m.	2.50	4.50 p. m.	6.50 p. m.	1.00	0.05	0.11	0.17	0.21	0.25	0.30	0.37	0.47	0.55	0.60	0.82	1.03	1.14	1.32
Nashville, Tenn.	28			0.61														0.43			
New Orleans, La.	11			0.63														0.51			
New York, N. Y.	18			0.33														0.27			
Norfolk, Va.	29-31			1.91														0.31			
Northfield, Vt.	18			0.38														0.23			
Oklahoma, Okla.	25-26	5.08 p. m.	4.00 a. m	2.52	6.13 p. m.	6.30 p. m.	0.28	0.24	0.44	0.59	0.63										
Omaha, Nebr.	24-25			1.44														0.43			
Parkersburg, W. Va.	‡			0.74														0.17			
Philadelphia, Pa.	17-18			0.79														0.68			
Pittsburg, Pa.	31			1.17														0.34			
Pocatello, Idaho	23			0.64														0.13			
Portland, Me.	‡			1.19														0.64			
Portland, Oreg.	18-19			1.64														0.22			
Raleigh, N. C.	5-6			2.08														0.47			
Richmond, Va.	5-6			1.80														0.38			
Rochester, N. Y.	28-29			0.37														0.13			
St. Louis, Mo.	16-17			0.87														0.34			
St. Paul, Minn.	24-25			1.48														0.29			
Salt Lake City, Utah.	13-14			0.69														0.20			
San Diego, Cal.	13			0.20														0.15			
San Francisco, Cal.	20-21			1.88														0.36			
Savannah, Ga.	7			0.70																	
Seattle, Wash.	19-20			0.83										0.48							
Spokane, Wash.	19			1.41														0.18			
Tampa, Fla.	3			1.39														0.15			
Vicksburg	28			0.64														0.40			
Washington, D. C.	‡			2.10														0.47			
Wilmington, N. C.	5-6			0.77														0.37			
Yankton, S. Dak.	2			0.41														0.51			
																		0.23			
Basseterre, St. Kitts	5-6	11.50 p. m.	2.50 a. m.	1.90	11.55 p. m.	1.05 a. m.	0.01	0.05	0.11	0.24	0.40	0.51	0.56	0.77	0.79	1.35	1.50	1.63	1.86	1.89	
Do	20	8.42 p. m.	D. N.	1.19	8.44 p. m.	9.09 p. m.	T.	0.25	0.57	0.83	1.03	1.11	1.13	1.14							
Bridgetown, Barbados	5	9.45 a. m.	11.05 a. m.	1.35	9.49 a. m.	10.40 a. m.	0.01	0.14	0.20	0.25	0.42	0.80	0.95	1.04	1.14	1.21	1.25	1.30	1.34		
Do	21	6.03 a. m.	7.45 a. m.	1.57	6.04 a. m.	6.55 a. m.	T.	0.16	0.32	0.47	0.55	0.65	0.95	1.17	1.31	1.41	1.50	1.53			
Cienfuegos, Cuba	28-29			1.18														0.24			
Havana, Cuba	28-29			2.54														0.70			
Kingston, Jamaica	16	12.40 a. m.	4.30 a. m.	2.17	12.45 a. m.	1.35 a. m.	0.02	0.10	0.40	0.72	0.88	0.97	1.09	1.43	1.81	1.99	2.03	2.05	2.09		
Do	19	2.38 p. m.	4.10 p. m.	1.28	2.50 p. m.	3.25 p. m.	0.06	0.10	0.19	0.47	0.72	0.90	1.04	1.07	1.11						
Do	27-28	7.30 a. m.	4.00 a. m.	5.16	[1]10.25 a. m.	[1]12.05 p. m.	0.88	0.11	0.17	0.20	0.22	0.24	0.28	0.36	0.39	0.53	0.56	0.87	0.98	1.08	
Do					[1]12.05 p. m.	[1]12.50 p. m.		1.16	1.20	1.27	1.41	1.72	2.17	2.39	2.46	2.49	2.52	2.56	2.61	2.65	2.80
Do	28-29	5.00 p. m.	7.43 p. m.	8.26	[2]9.05 p. m.	[2]11.05 p. m.	0.33	0.16	0.24	0.25	0.34	0.36	0.37	0.38	0.57	0.86	1.17	1.40	1.42	1.58	2.13
Do					[3]5.30 a. m.	[3]6.30 a. m.	3.06	0.15	0.38	0.50	0.53	0.73	1.06	1.25	1.45	1.52	1.54				
Do					[3]7.10 a. m.	[3]7.55 a. m.	4.83	0.08	0.18	0.47	0.54	0.54	0.55	0.65	1.03	1.26	1.27	1.29	1.58	1.65	1.95
Port of Spain, Trin.	16	2.20 p. m.	4.35 p. m.	2.19	2.49 p. m.	3.50 p. m.	0.22	0.08	0.22	0.25	0.35	0.52	0.75	1.03	1.27	1.48	1.65	1.91	1.95		
Puerto Principe, Cuba	27-29			4.47														0.72			
San Juan, Porto Rico	1	2.19 p. m.	4.50 p. m.	2.64	2.20 p. m.	3.15 p. m.	T.	0.29	0.69	1.05	1.35	1.75	2.01	2.21	2.31	2.36	2.41	2.48	2.56	2.61	2.64
Do	2	3.26 p. m.	7.20 p. m.	1.05	3.40 p. m.	4.30 p. m.	0.07	0.14	0.40	0.55	0.66	0.71	0.72	0.76	0.80	0.85	0.90	0.92			
Do	23	11.01 a. m.	11.20 a. m.	0.80	11.05 a. m.	11.20 a. m.	T.	0.23	0.65	0.80											
Do	25	12.50 p. m.	6.30 p. m.	1.96	1.35 p. m.	2.20 p. m.	0.03	0.09	0.22	0.26	0.30	0.39	0.70	1.04	1.38	1.50	1.52	1.59			

TABLE IX.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration.		Total am't of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time as indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Santiago de Cuba	24	2.25 p. m.	5.20 p. m.	1.25	3.00 p. m.	3.45 p. m.	0.08	0.08	0.21	0.43	0.58	0.77	0.92	1.00	1.07	1.13	1.15	1.16	.....	.....	.....
Do	26-27	D. N.	7.12 a. m.	3.47	2.30 a. m.	3.20 a. m.	0.44	0.04	0.10	0.17	0.28	0.39	0.44	0.54	0.59	0.65	0.67	.....	.....	.....	.....
Do	.....	.....	.....	.....	3.20 a. m.	4.20 a. m.	.....	0.73	0.81	0.89	1.03	1.34	1.60	1.72	1.96	2.29	2.51	2.60	2.64	2.75	.....
Do	28	10.40 a. m.	4.50 p. m.	1.83	1.33 p. m.	2.00 p. m.	0.24	0.33	0.41	0.60	0.93	1.06	1.09	1.11	1.12	1.12	1.12	1.35	1.44	.....	.....
Do	29	9.51 a. m.	11.42 a. m.	0.98	11.00 a. m.	11.35 a. m.	0.04	0.05	0.25	0.62	0.73	0.74	0.80	0.93	0.94	.....	.....	.....	.....	.....	.....
Do	29-30	7.05 p. m.	D. N.	2.50	8.20 p. m.	8.45 p. m.	0.47	0.13	0.46	0.74	1.08	1.17	1.17	1.18	1.37	1.41	1.46	1.56	.....	.....	.....
Santo Domingo, W. I..	10-11	11.05 p. m.	5.10 a. m.	1.88	1.50 a. m.	2.40 a. m.	0.21	0.15	0.29	0.42	0.59	0.78	0.99	1.16	1.32	1.51	1.59	1.63	....	.....	.....
Do	18	2.10 p. m	10.25 p. m.	1.00	2.17 p. m.	2.40 p. m.	0.01	0.15	0.49	0.61	0.72	0.77	0.78	.....	.....	.....	.....	.....	.....	.....	.....
Do	26-27	11.40 p. m.	7.55 p. m.	4.55	11.15 a. m.	1.00 p. m.	2.18	0.10	0.17	0.40	0.59	0.83	0.96	1.05	1.19	1.37	1.42	1.50	1.67	1.85	.....
Do	28	11.10 a. m.	11.10 p. m.	4.59	2.10 p. m	3.10 p. m	0.81	0.08	0.19	0.35	0.52	0.69	0.98	1.10	1.17	1.22	1.29	1.37	.....	.....	.....
Willemstad, Curaçao..	8	10.00 p. m.	11.45 p. m.	0.67	10.05 p. m.	10.30 p. m.	0.02	0.07	0.29	0.48	0.57	0.63	0.64	.....	.....	.....	.....	.....	.....	.....	.....

•Self-register out of order. †Estimated, self-register out of order. ‡October 31–November 1. §12.35 p. m. to 1.40 p. m., 2d. ‖4.00 p. m. to 5.25 p. m., 2d.
[1] October 27. [2] October 28. [3] October 29.

TABLE X.—*Excessive precipitation, by stations, for October*, 1899.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
	Inches.	*Inches.*		*Ins.*	*h.m.*	
Alabama.						
Newton		6.22	4-5			
Arkansas						
Elon		2.79	10-11			
Fayetteville		4.74	26-27			
Hardy		2.55	16-17			
Winslow		4.03	26-27			
California.						
Bear Valley	14.16	8.01	20-21			
Berkeley		3.22	20-21			
Bowman	16.27	11.05	19-21			
Crescent City		4.34	19			
Edmanton	15.38	9.89	19-20			
Folsom		2.70	20-21			
Fordyce	13.85	8.30	20-21			
Georgetown		4.20	21			
Grass Valley	10.33	6.24	20-21			
Greenville	10.08	7.32	20-21			
Iowa Hill		3.39	20-21			
Laporte	18.30	14.54	19-21			
Nevada City	10.24	4.23	21			
Malakoff Mine	14.52	10.90	19-21			
North San Juan	10.04	6.65	20-21			
Oakland		2.94	21			
Oleta		2.86	21			
Palermo		2.65	21			
Pilot Creek	10.92	4.96	21			
Quincy	11.88	8.18	20 21			
Represa		3.13	21			
Riovista		2.55	21			
Santa Cruz		3.15	20			
Sonoma		3.09	20			
Thermalito		5.13	20-21			
Upper Mattole		5.65	19-20			
Wire Bridge		3.40	21			
Delaware.						
Milford		2.83	6			
Millsboro		3.32	6			
Florida.						
Bartow		3.24	3			
Clermont		3.00	3			
Dalkeith		3.81	4			
De Funiak Springs		4.00	4			
Fort Meade		2.50	2			
Jupiter	16.66	10.60	2-4	1.90	1 20	2
Do				1.63	1 18	2
Key West		3.20	3			
Kissimmee	15.98	11.60	2-3			
Lemon City	10.20	3.55	3-4			
Manatee		3.87	3-4			
Merritt Island	21.88	16.64	3-4			
New Smyrna	14.86	7.50	3-4			
Orange City		4.47	4			
Orlando		4.91	3-4			
Plant City		2.65	2-3			
St. Andrews		3.52	4			
St. Francis Barracks		3.20	4			
Sebastian	29.10	19.08	2-3			
Do		3.45	29			
Tallahassee		3.08	4			
Georgia.						
Allentown		3.08	4-5			
Do		2.58	7			
Americus		2.70	4-5			
Blakely		3.00	4			
Fort Gaines		6.59	4-5			
Harrison		3.25	5			
Lumpkin				1.00	0 30	19
Marshallville		4.40	5	1.57	1 00	19
Putnam		2.60	5			
Talbotton		3.70	7			
Waynesboro		2.50	5-6			
Illinois.						
New Burnside		2.91	16-17			
Indian Territory.						
Tulsa		4.23	25-26			
Iowa.						
Fayette		2.72	14			
Glenwood		2.60	25			
Ovid		2.51	10-11			
Redoak		2.98	25			
Sigourney				1.25	0 30	10
Thurman		3.72	24-25			
Kansas.						
Campbell		5.25	24-25			
Concordia		4.38	24-25			
Delphos		3.48	24-25			
Dodge		3.33	24-25	2.05	1 30	24
Garfield		3.40	25			
Russell		3.52	25			
Kentucky.						
Earlington		2.90	27-28			
Louisiana.						
Emilie				1.50	1 00	18
Houma		4.15	11			
Maryland.						
Laurel		2.70	31			
Pocomoke City		3.06	5-6			
Princess Anne		2.60	5-6			
Massachusetts.						
Nantucket		2.50	6			

TABLE X.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
	Inches.	*Inches.*		*Ins.*	*h.m.*	
Minnesota.						
Faribault		2.65	24			
Lake City		2.87	24-25			
Long Prairie		2.96	14-15			
Milaca		5.33	14-15			
New London		2.55	12			
Pine River		2.56	15-16			
St. Cloud		2.80	10			
Do		3.20	15			
Missouri.						
Sikeston		2.53	17			
Springfield		2.74	27-28			
Warrenton		2.97	26-27			
Nebraska.						
Auburn		3.42	24-25			
Beatrice		2.96	24-25			
Chester		2.60	25			
Clatonia		3.40	24-25			
Crete		2.62	25-26			
Dawson		2.85	25			
Eden		4.02	24-25			
Fairbury		3.02	24			
Hebron		2.99	24-25			
Nebraska City		2.92	24-25			
Nemaha		3.75	24-25			
Odell		2.75	25			
Palmyra		2.82	24-25			
Pleasanthill		3.00	24			
Strang		2.75	24-25			
Syracuse		2.70	25			
Tablerock		3.20	24-25			
Tecumseh		2.75	25			
Turlington		3.16	24-25			
Wilber		2.75	25			
Wymore		3.10	25			
New Jersey.						
Cape May C. H.		2.58	6			
Ocean City		2.70	6			
North Carolina.						
Chapelhill		3.07	5-6			
Durham		2.55	6			
Edenton		2.50	31			
Fairbluff		3.08	30-31			
Hatteras		3.23	30-31			
Kittyhawk		3.50	30-31			
Lumberton		4.06	30-31			
Pantego		3.60	30-31			
Pittsboro		3.14	5			
Rockingham		3.05	5			
Do		3.85	30-31			
Soapstone Mount		2.98	30-31			
Southport		3.90	30-31			
Southern Pines		2.52	6			
Do		3.65	30-31			
Weldon		2.77	5-6			
Oklahoma.						
Fort Sill		4.10	25-27			
Guthrie		3.03	25			
Hennessey		2.50	25			
Kingfisher		4.28	25-26			
Norman		4.46	25			
Oklahoma		3.18	25-26			
Pawhuska		3.97	25-26			
Perry		3.60	25-26			
Sac and Fox Agency		2.90	25-26			
Stillwater		4.05	25-26			
Oregon.						
Alpha		2.70	18			
Astoria	10.28					
Glenora	10.75	3.50	18			
Government Camp	10.23	2.60	1			
Kerby		4.70	19			
Nehalem	11.32	3.40	15			
Placer		4.00	19			
South Carolina.						
Allendale		3.20	30-31			
Batesburg		2.50	30-31			
Beaufort		4.97	30-31			
Blackville		2.83	5-6			
Do		5.43	30-31			
Camden		3.06	30-31			
Cheraw		2.86	30-31			
Columbia		2.82	30-31			
Darlington		4.60	30			
Effingham		2.70	30-31			
Holland		3.85	5			
Little Mountain		2.66	5			
Do		3.22	30-31			
Longshore		2.52	5			
Pinopolis		4.22	30-31			
St. Matthews		3.50	30-31			
Shaws Fork		3.00	5			
Do		3.05	30-31			
Smiths Mills		2.95	30-31			
Societyhill		4.03	30-31			
Statesburg		3.60	30-31			
Summerville		3.93	30-31			
Temperance		3.08	30-31			
Trenton		2.81	5			
Trial		4.00	30-31			
Winnsboro		3.05	5			

TABLE X.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
South Carolina.—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Winnsboro		2.80	30			
Yemassee		5.20	30-31			
Tennessee.						
Lynnville				1.85	1 00	19
Texas.						
Abilene		2.60	26			
Alvin		5.22	10			
Austin		3.10	26			
Blanco		3.72	26-27			
Boerne		4.90	26-27			
Brazoria		6.40	9-10			
Columbia		4.25	9-10			
Conroe		2.78	10			
Corpus Christi		3.92	9-10			
Corsicana		2.70	26			
Danevang		4.10	9-10			
Dublin		2.73	26-27			
Duval		2.90	26			
Fruitland		3.54	26-27			
Hearne		4.35	27			
Henrietta		2.67	25-26			
Hewett		2.70	19			
Houston		3.50	9-10			
Hulen		5.93	10			
Kerrville		2.70	26-27			
Laureles Ranch		2.65	10			
Llano		2.55	6			
Longview		4.55	26-27			
Palestine		5.31	26-27	1.30	0 30	26
Rhineland		3.64	25			
Sugarland		2.85	9-10			
Sulphur Springs		2.69	26-27			
Temple		2.50	26			
Wichita Falls		5.00	26			
Virginia.						
Birdsnest		3.05	6-7			
Callaville		2.69	5-6			
Hampton		2.69	5-6			
Sunbeam		2.78	5-6			
Washington.						
Cedarlake	12.87	2.90	16			
Clearwater	13.73					

TABLE X.—*Excessive precipitation.*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Washington—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Monte Cristo	10.21					
Neah	11.22					
Wisconsin.						
Hayward		3.69	14-15			
Prentice		3.48	24-25			
Cuba.						
Puerto Principe		3.95	28-29			
Santiago de Cuba	19.06	6.26	26-27	1.05	0 37	24
Do				1.68	0 37	27
Do				1.05	0 23	28
Do				1.10	0 19	29
Porto Rico.						
Adjuntas	11.75					
Bayamon		2.52	1			
Do		2.59	20			
Cidra		2.69	25			
Coloso	11.60	3.90	13			
Fajardo	17.07	7.30	26-27			
Lajas	12.33	2.70	10			
Luquillo	17.74	7.48	26-27			
Monserrate	11.45	2.70	13			
Ponce	11.04	3.27	6			
San Juan	10.21	2.73	1-2	2.31	0 40	1
Do				1.18	0 22	25
San Lorenzo		2.65	13			
Vieques	10.43					
West Indies.						
Basseterre, St. Kitts				1.70	1 00	6
Do				1.08	0 24	20
Bridgetown, Barbados				1.17	0 58	5
Do				1.53	0 59	21
Kingston, Jamaica	21.64	15.13	27-29	2.07	0 40	16
Do				1.07	0 32	19
Do				1.16	0 21	27
Do				1.03	0 19	28
Do				1.54	0 49	28
Port of Spain, Trinidad		2.75	16-17	1.89	1 00	16
Roseau, Dominica				1.00	1 00	20
Santo Domingo, Santo Domingo	14.71	10.01	26-28	1.59	0 50	11
Do				1.43	0 48	27
Do				1.13	0 37	28

TABLE XI.—*Data furnished by the Canadian Meteorological Service, October*, 1899.

Stations.	Pressure.			Temperature.				Precipitation.		
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F.	29.86	30.00	+.06	47.5	+ 2.1	53.6	41.3	1.95		
Sydney, C. B. I.	30.09	30.13	+.17	48.5	+ 2.0	57.1	40.0	4.48	+0.18	
Halifax, N. S.	30.07	30.18	+.20	50.5	+ 3.3	59.7	41.4	6.17	+0.78	
Grand Manan, N. B.	30.14	30.20	+.26	49.5	+ 2.6	55.5	43.5	2.52	−2.16	0.1
Yarmouth, N. S.	30.13	30.21	+.23	48.8	+ 1.2	55.7	41.9	6.44	+2.41	1.2
Charlottet'n, P. E. I.	30.10	30.14	+.22	48.4	+ 1.9	55.7	41.1	4.76	+0.28	
Chatham, N. B.	30.14	30.16	+.20	47.1	+ 4.1	56.5	37.7	2.80	−1.09	T.
Father Point, Que.	30.13	30.16	+.20	40.5	+ 0.7	48.4	32.6	1.45	−1.17	
Quebec, Que.	29.86	30.19	+.20	45.4	+ 3.0	52.7	38.1	2.04	−1.61	T.
Montreal, Que.	29.97	30.18	+.18	48.4	+ 3.6	55.1	41.6	3.39	−0.22	T.
Bissett, Ont.	29.59	30.21	+.19	44.3	+ 2.8	55.6	33.1	1.94	−0.76	0.2
Ottawa, Ont.	29.85	30.17	.....	47.4	+ 3.6	55.5	39.2	2.47	.....	
Kingston, Ont.	29.88	30.20	+.17	50.4	+ 3.4	58.1	42.7	2.30	−0.70	
Toronto, Ont.	29.81	30.19	+.15	50.8	+ 4.2	59.3	42.4	4.54	+2.25	
White River, Ont.	28.76	30.13	+.11	40.7	+ 3.6	50.6	30.8	2.06	−0.39	0.2
Port Stanley, Ont	29.53	30.17	+.14	52.2	+ 4.4	60.2	44.2	5.46	+2.18	
Saugeen, Ont.	29.46	30.18	+.18	50.5	+ 4.1	59.2	41.7	3.14	−0.67	
Parry Sound, Ont	29.47	30.17	+.16	48.6	+ 4.7	57.7	39.4	3.08	−1.24	
Port Arthur, Ont.	29.33	30.04	+.04	44.3	+ 4.4	52.5	36.1	1.79	−0.90	
Winnipeg, Man.	29.13	29.96	−.03	42.2	+ 3.1	52.1	32.3	1.85	+0.12	T.
Minnedosa, Man.	28.15	29.98	+.01	39.7	+ 1.9	49.5	29.9	2.03	+0.47	10.4
Qu'Appelle, Assin.	27.68	29.98	+.01	36.8	− 2.6	45.2	28.4	2.83	+1.81	28.2
Medicine Hat, Assin.										
Swift Current, Assin.	27.40	30.02	+.03	38.2	− 3.9	47.3	29.1	1.07	−0.16	3.7
Calgary, Alberta	26.36	29.95	−.01	36.7	− 3.4	47.2	26.2	1.31	+0.95	10.4
Banff, Alberta	25.32	30.02	.....	35.1	.....	42.8	27.4	0.84	.....	6.1
Edmonton, Alberta	27.61	29.95	−.01	35.9	− 5.2	44.4	27.4	1.34	+0.77	13.4
Prince Albert, Sask.	28.37	29.94	.....	36.6	− 0.5	45.5	27.7	1.53	.....	2.0
Battleford, Sask.	28.23	30.00	.....	36.7	− 2.9	45.6	27.8	0.85	.....	2.1
Kamloops, B. C.	28.75	30.04	.....	45.6	.....	52.2	38.9	0.42	.....	
Victoria, B. C.	29.92	.....	.....	49.5	.....	54.9	44.1	3.38	.....	
Barkerville, N. W. T.	25.36	29.93	.....	34.3	.....	42.1	26.5	2.22	.....	12.0
Hamilton, Bermuda.	29.92	30.08	+.06	73.7	+ 0.7	77.4	70.1	1.96	.....	

Chart I. Tracks of Centers of High Areas, October, 1899

Chart I. Tracks of Centers of High Areas. October, 1899.

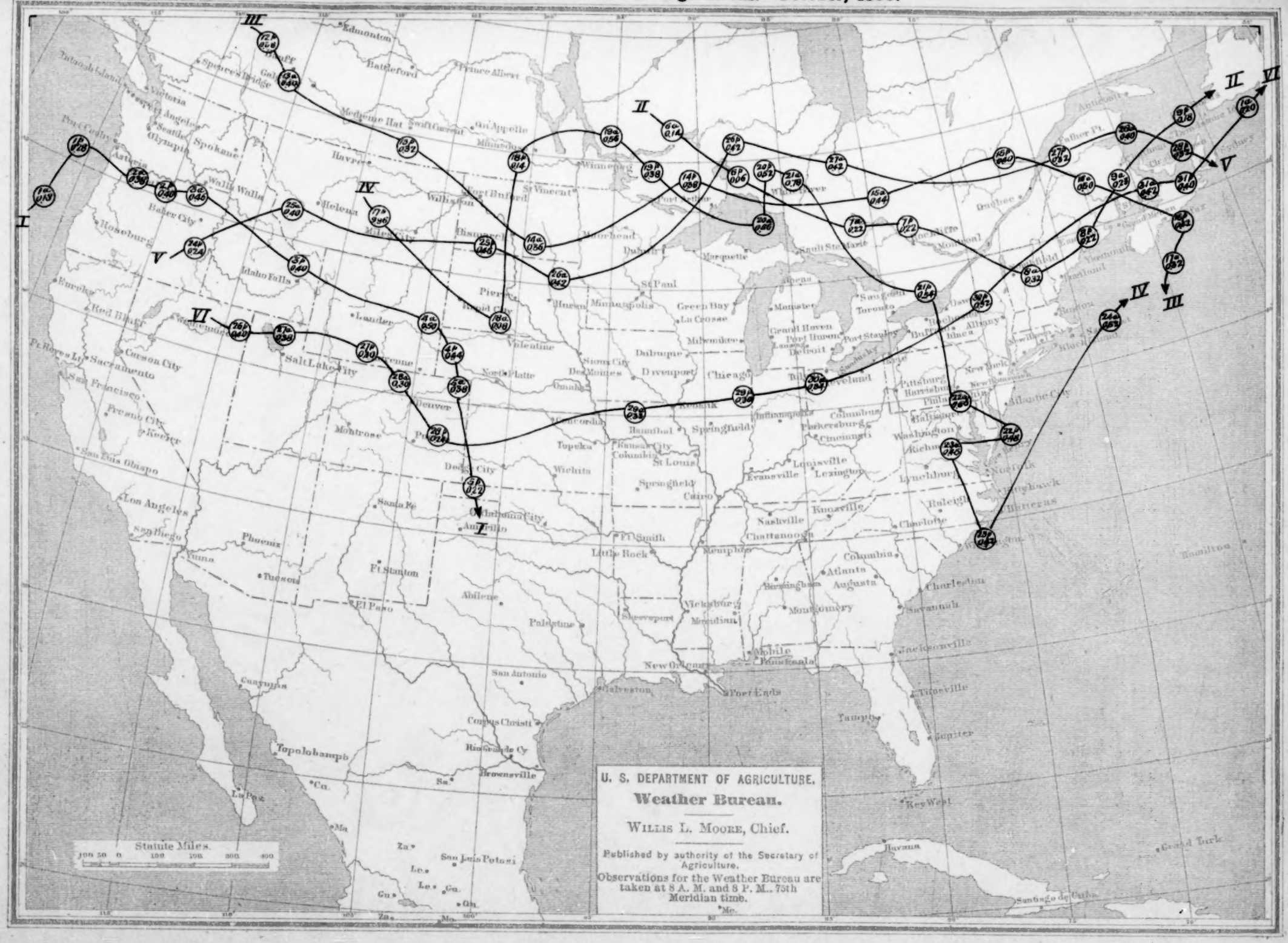

Chart II. Tracks of Centers of Low Areas. October, 1899.

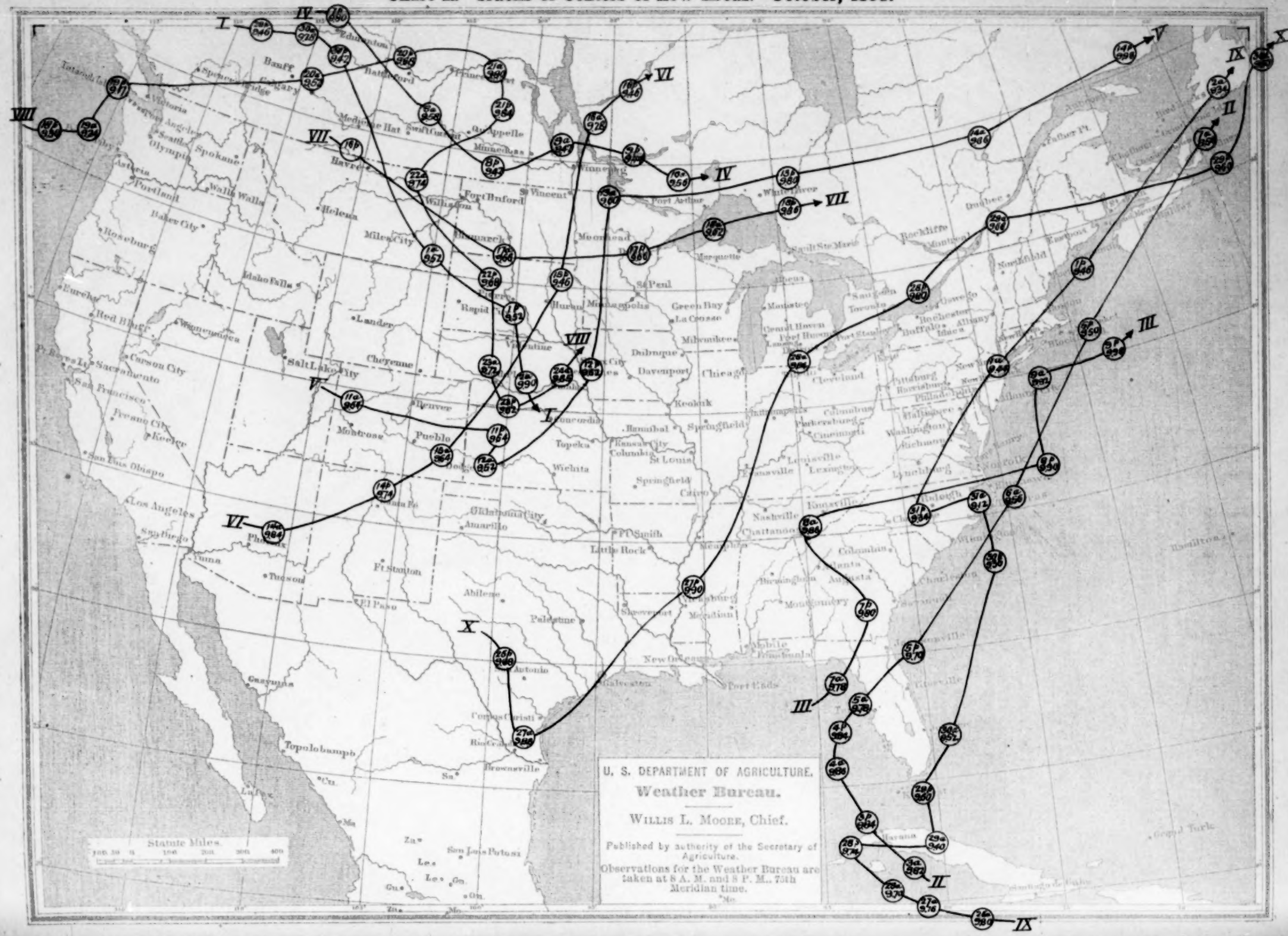

Chart III. Total Precipitation. October, 1899.

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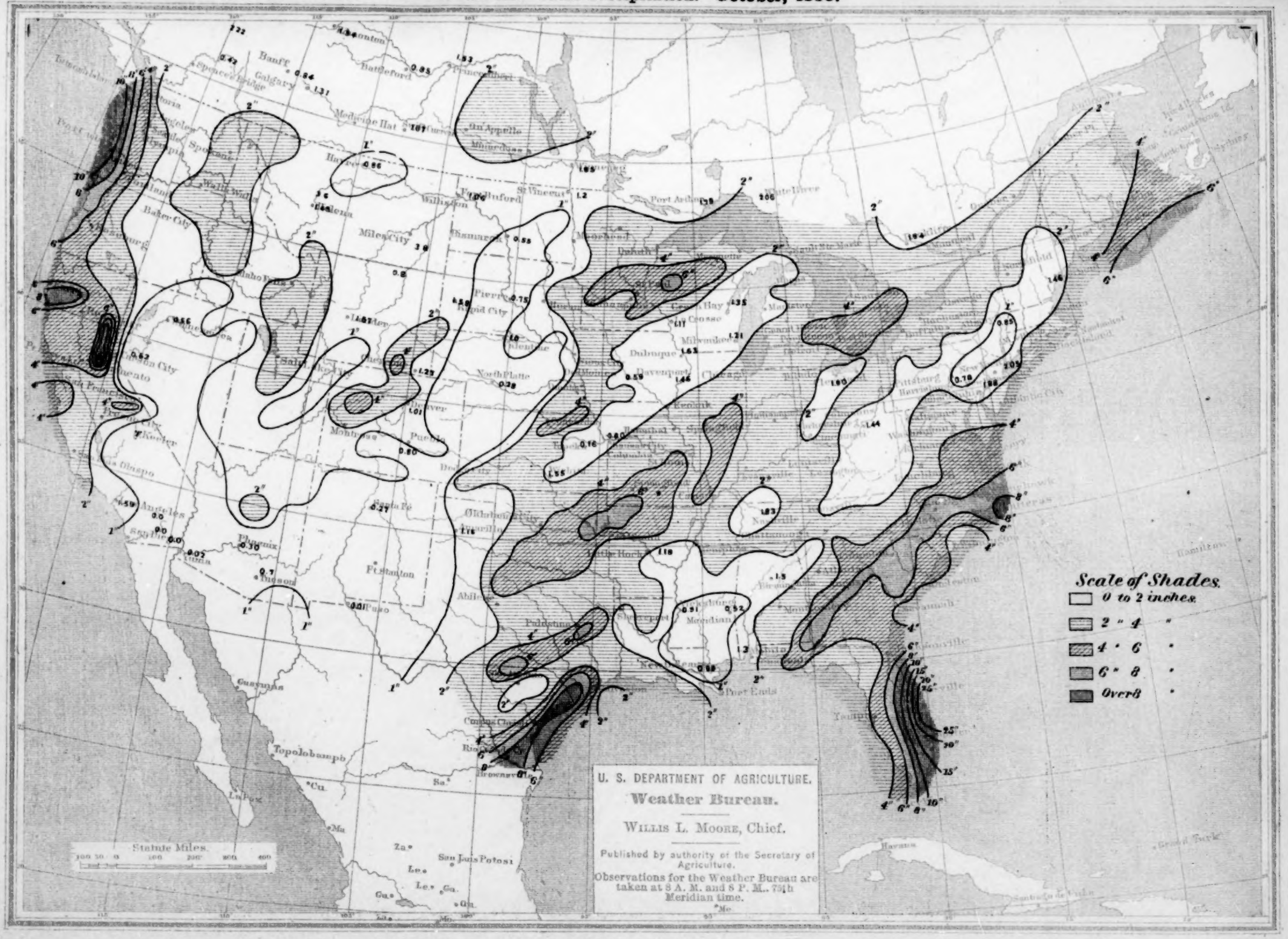
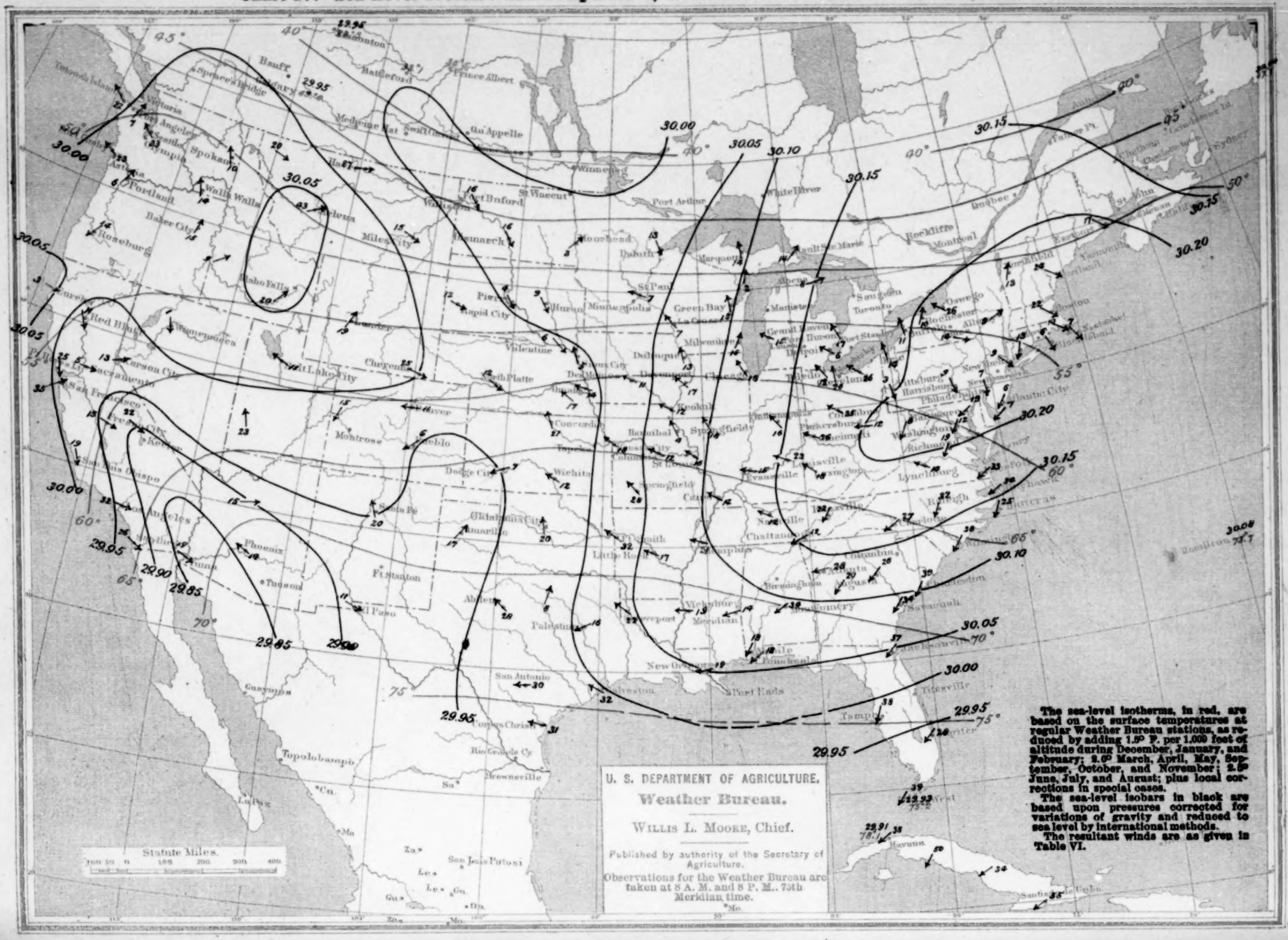

Scale of Shades.
0 to 2 inches.
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
Statute Miles.
100 50 0 100 200 300 400
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. October, 1899.


Statute Miles.
0 100 200 300 400
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
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The sea-level isotherms, in red, are based on the surface temperatures at regular Weather Bureau stations, as reduced by adding 1.5° F. per 1,000 feet of altitude during December, January, and February; 2.0° March, April, May, September, October, and November; 2.5° June, July, and August; plus local corrections in special cases.
The sea-level isobars in black are based upon pressures corrected for variations of gravity and reduced to sea level by international methods.
The resultant winds are as given in Table VI.

Chart V. Hydrographs for Seven Principal Rivers of the United States. October, 1899.

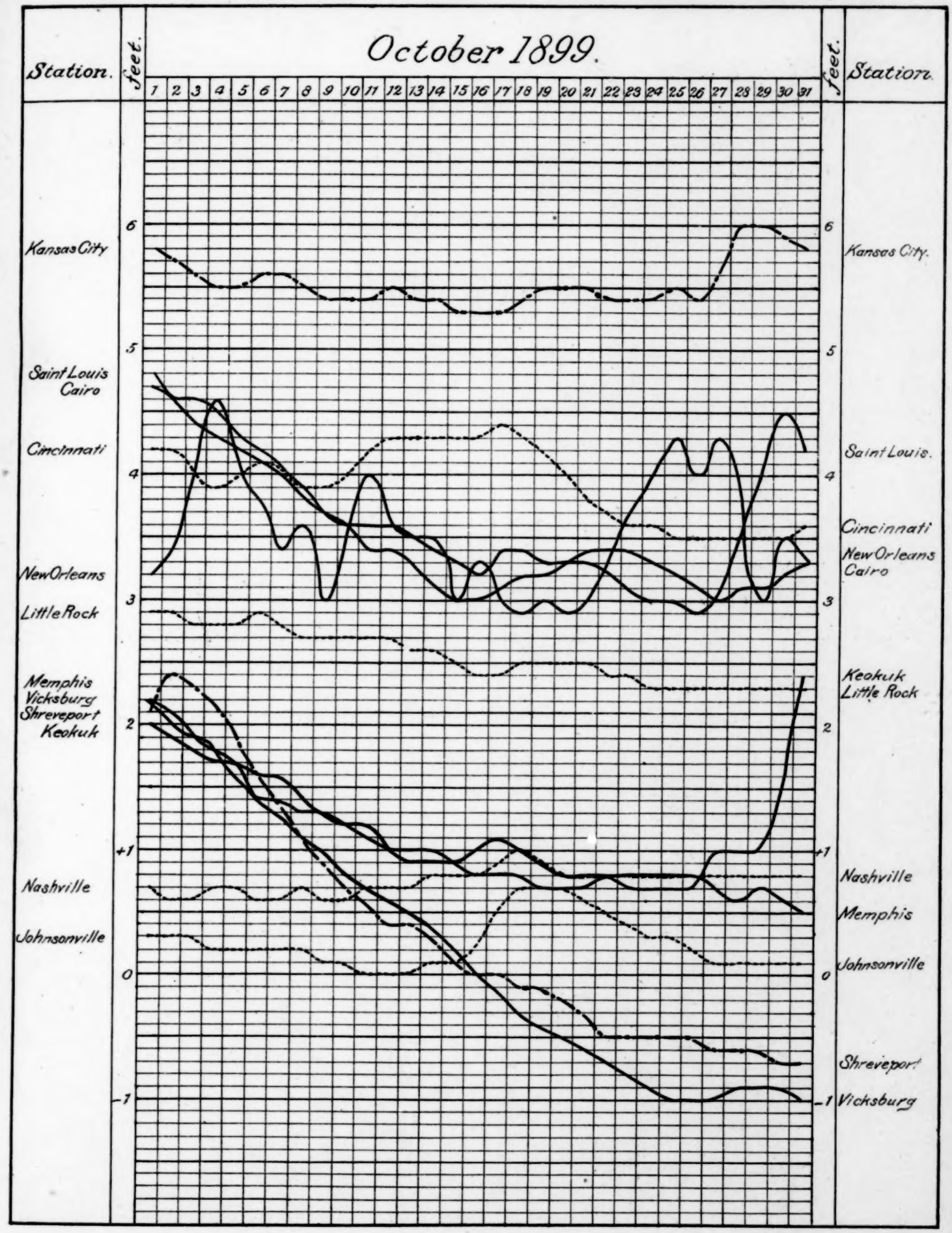
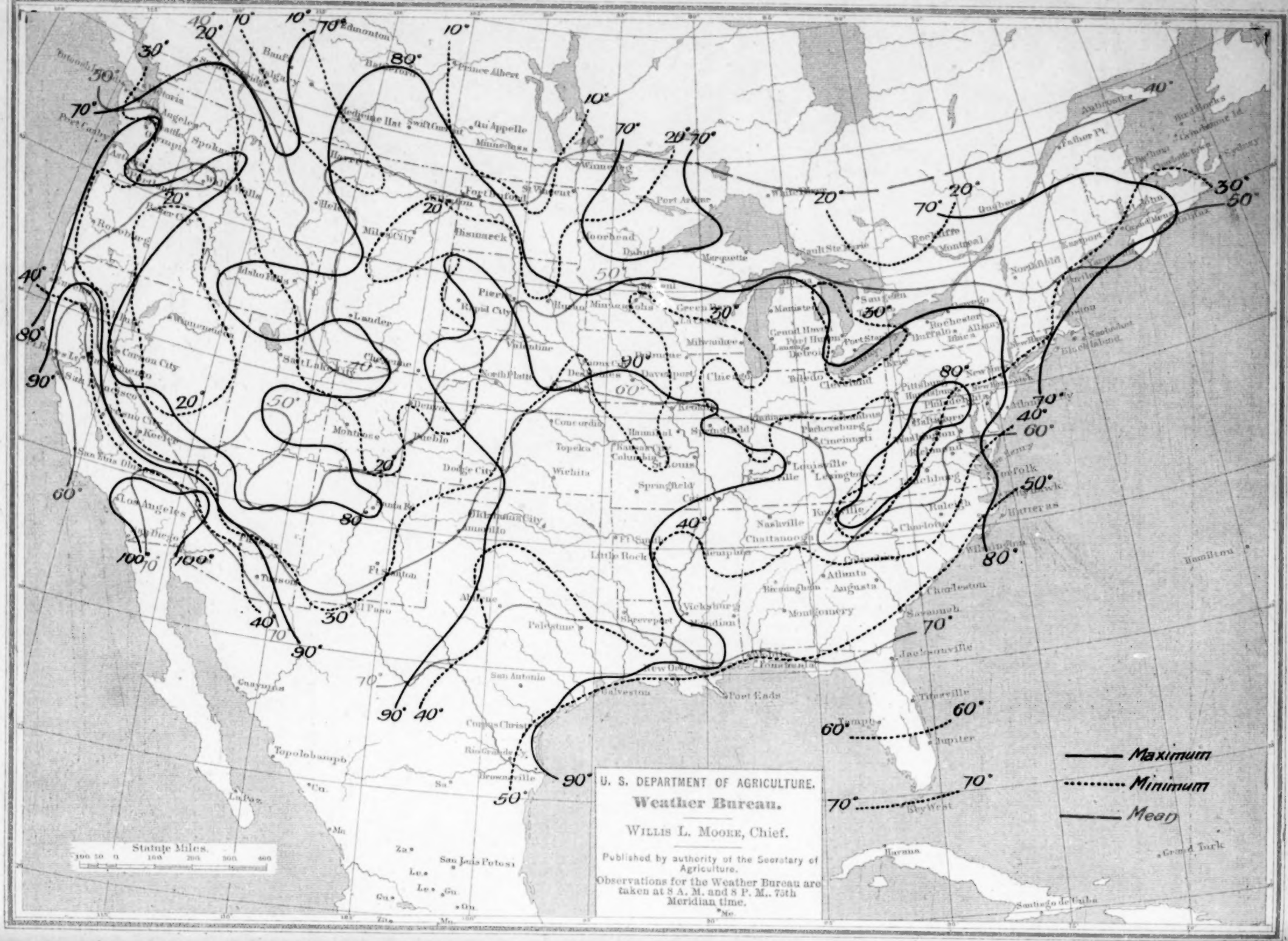


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. October, 1899.


U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
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Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles.
Maximum
Minimum
Mean

Chart VII. Percentage of Sunshine. October, 1899.

Chart VII. Percentage of Sunshine. October, 1899.

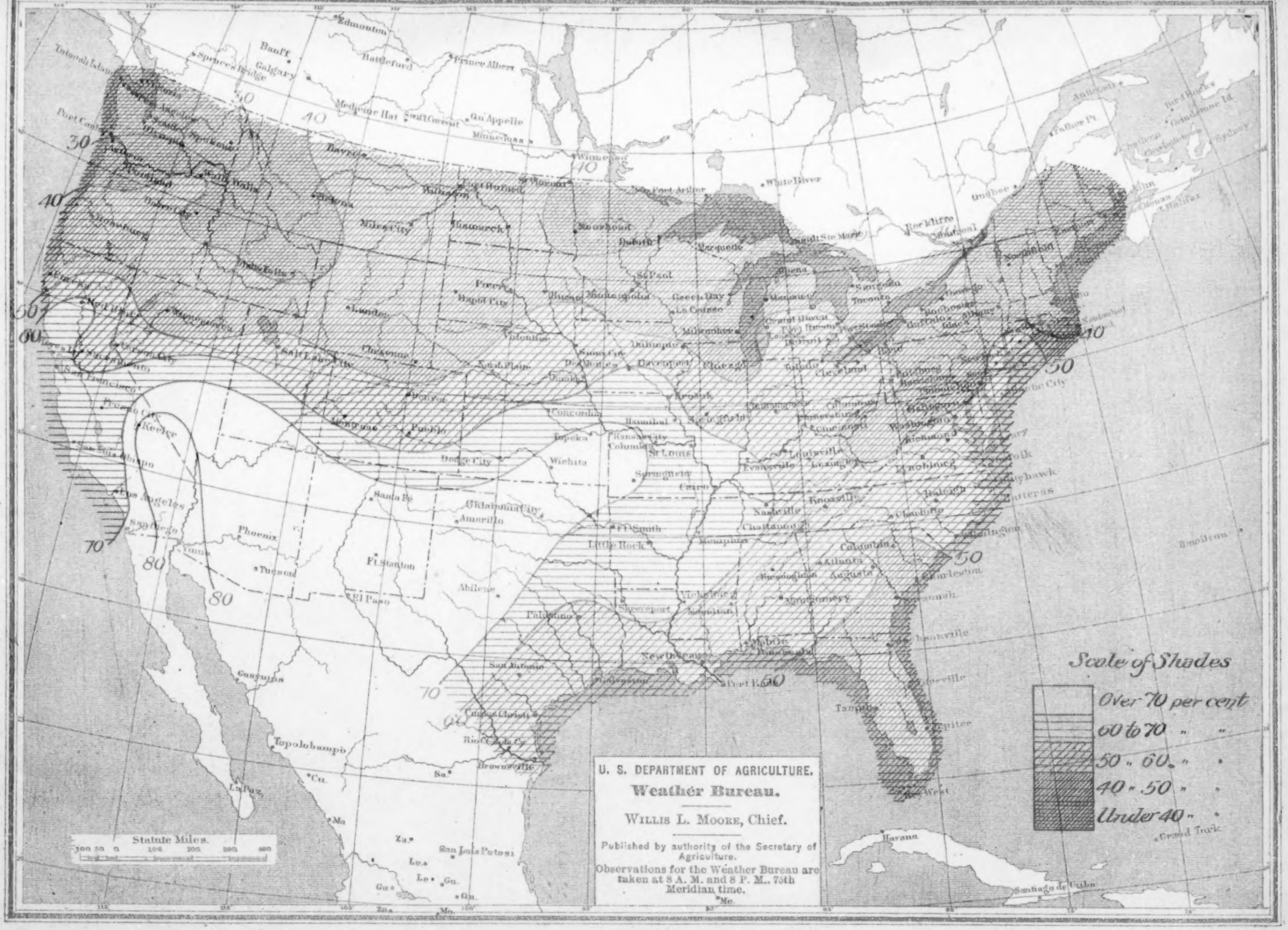

Chart VIII. Total Snowfall for October, 1899.

Western
and
Southern
Limit of Snow
Statute Miles
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
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Chart IX. West Indian Monthly Isobars, Isotherms, and Resultant Winds. October, 1899.

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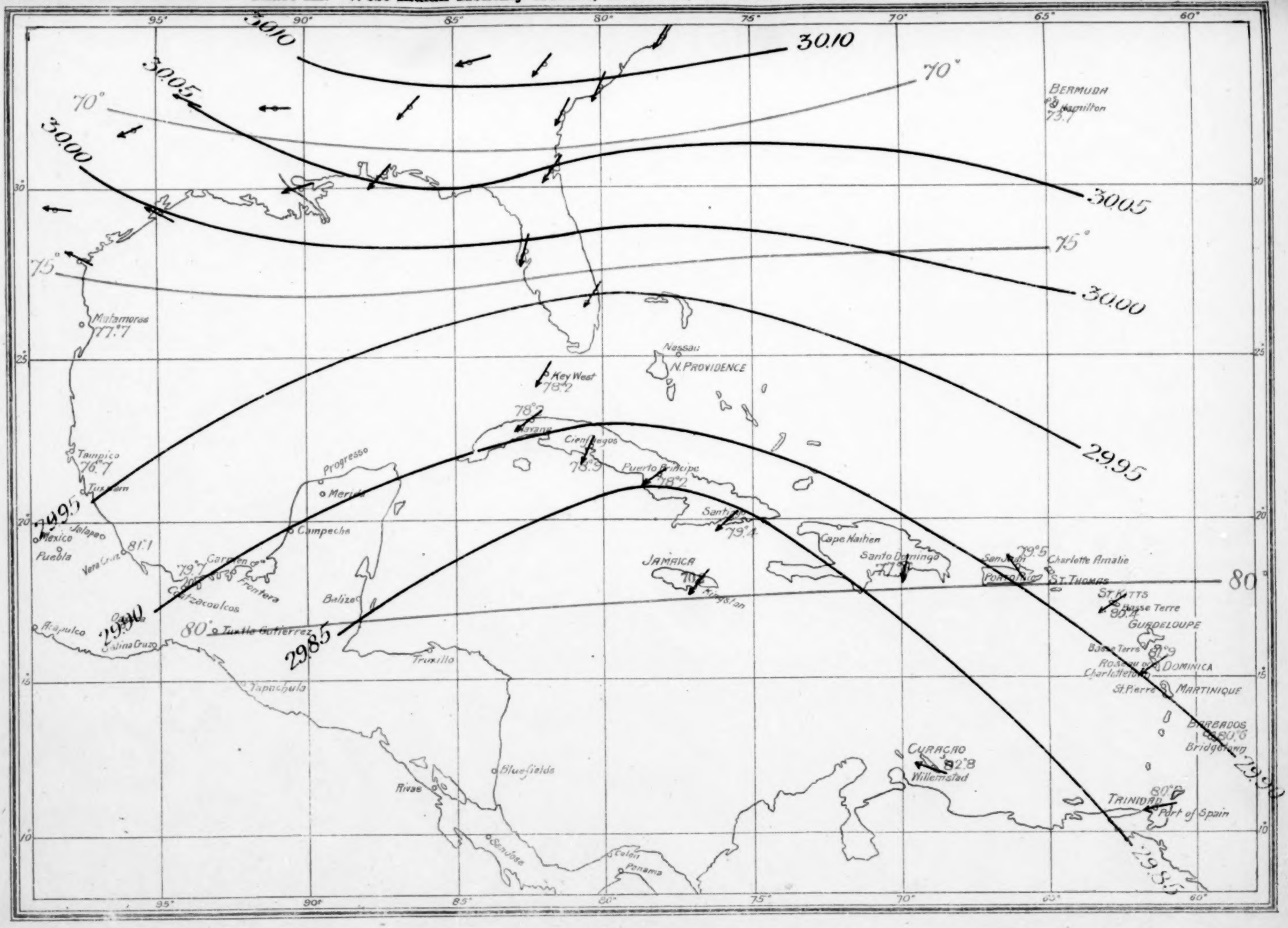

Plate 1.

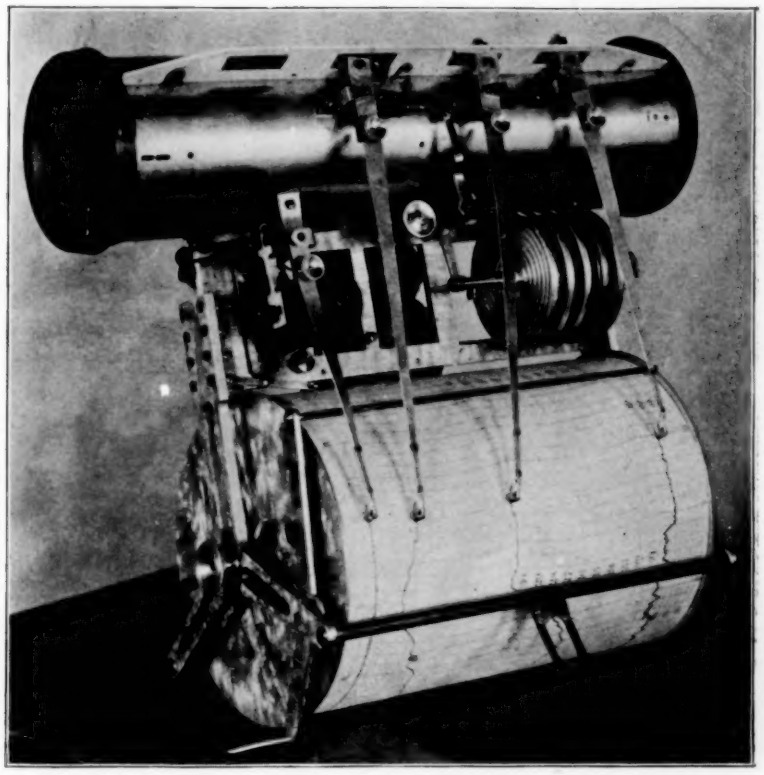

FIG. 2.—Marvin's kite meteorograph.

FIG. 3.—Thermograph bulb of Marvin's kite meteorograph.